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THE
JOURNAL OF APPLIED PSYCHOLOGY

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THE PERCEPTION OF SLIGHT CHANGES OF EQUILIBRIUM, WITH ESPECIAL REFERENCE TO PROBLEMS OF AVIATION[1]

By HAROLD E. BURTT

I. *Introduction*

Previous experiments upon the perception of changes ot equilibrium have been performed on the tilting-board.[2] The subject, usually prone upon the board, was tilted to various positions and required to report the angle of tilt or to indicate the vertical. It is obvious that this type of estimation is quite dissimilar to that made by an aviator during flight. In an airplane one occupies a sitting posture and responds to relatively slight deviations from the perpendicular, and it is a case not of deliberate judgment but of choice reaction, correcting the motion of the plane the instant the direction of the tilt is perceived. Accordingly some experiments were performed bearing more directly upon the practical situation. Two problems were studied:

1. What is the relative delicacy of perception of slight changes of equilibrium in the various directions right, left, front and back? Differences in such perception, if general, would have a practical bearing on the selection or arrangement of airplane controls so as to facilitate reactions to the more difficult perception.

2. What are the merits of dep as compared with stick airplane control in reacting to slight changes of equilibrium? If the use of one hand on the stick or two hands on the dep

[1]From the Harvard Psychological Laboratory.

[2]This work is summarized in Nagel's *Handbuch der Physiologie des Menschen*, 1905, vol. 3, p. 736 ff.

and the different movements involved constitute a variable sufficient to influence the reaction time, this fact might warrant the general adoption of one or the other type of control.[8]

II. *Method*

A heavy wooden platform 1 meter square was mounted so as to rock about a point 35 cm. below its centre. Iron braces from its corners met at a rounded plate below the centre and this rested on a flat plate on the base of the apparatus. A loose bolt held it in place. Heavy spiral springs under a little tension were attached from each corner of the platform to the base directly below. The platform was thus held normally in a horizontal position, but a moderate force applied to a corner would tip it in the desired direction.

The platform was tilted in some of the experiments by means of a crank and worm gear mounted on an upright about 50 cm. back of the platform. A sprocket on the shaft with the worm carried a short chain from the ends of which wire ropes led to two opposite corners of the platform through pulleys directly below the sprocket and other pulleys below the corners. The ropes were made taut by means of turnbuckles. Turning the crank lowered a corner of the platform and turning it in the opposite direction righted the platform or lowered the opposite corner. The wire ropes could be replaced at will by a set connected similarly with the other two corners. The arrangement was such that one turn of the crank lowered the desired corner about 6.35 mm., and the speed and distance could thus be controlled.

This arrangement, however, permitted the tilting of the platform at only relatively slow speeds, and therefore in some of the experiments a different system was employed. A heavy spiral spring, (heavier than those at the corners of the platform) was hung on one end of the chain on the above mentioned sprocket. From the lower end of this spring another chain passed under a second sprocket mounted on the base to the wire rope leading to a corner of the platform. Fastened rigidly to this second sprocket was a ratchet held by a pawl. Thus the heavy spring could be placed under any desired tension between the upper sprocket and the ratchet without disturbing the platform. When the ratchet was released the lower sprocket acted as a pulley while the upper one was stationary and the corner of the platform was quickly lowered,

[8]Two untechnical accounts of these experiments by the author have appeared in *Aviation and Aeronautical Engineering*, vol. 2, 1917, pp. 218 ff. and pp. 562 ff.

the rate and distance depending on the amount of tension placed on the heavy spring. An identical arrangement was connected to the other end of the upper chain so that two opposite corners of the platform could be operated reciprocally by turning the crank in the desired direction and thus operating the desired spring and ratchet. A single lever threw both pawls simultaneously and whichever spring was under tension would operate. Trials in two opposite directions could thus be given rapidly. To change to the other two directions required only a few minutes to connect the other ropes to the chains and adjust the turnbuckles. The springs gave the platform a negatively accelerated tilt such as an airplane makes when struck by a puff of wind or the like.

A chair was mounted on the platform facing one corner in such a way that the vertical axis through the center of gravity of the subject sitting in a normal position passed through the center of the platform. Thus a lowering of the corners tipped the subject directly forward, backward, right or left. In the work on the first problem the chair was an ordinary one which placed the subject's ears approximately 160 cm. above the point about which the mechanism rocked. In the second problem a lower chair was used and the subject's feet rested on a bar only a little lower than the seat of the chair (the position usually occupied by an aviator). In this case the subject's ears were about 130 cm. above the rocking plate.

Visual factors were eliminated throughout the entire experiment, the subject always having the eyes closed during a trial. The subjects with one exception were graduate students in the Harvard Psychological Laboratory. The remaining one had had considerable psychological experience. Two of the subjects were women.

III. *Perception of Lateral vs. Longitudinal Changes of Equilibrium*

In studying the delicacy of perception of a tilt in various directions both forms of apparatus mentioned above were employed. With the first arrangement the experimenter turned the crank at a constant rate (1 revolution in 2 or 4 seconds) timing himself by a pilot lamp flashed once a second by the laboratory time circuit. This speed lowered the desired corner of the platform at a constant rate of 3.175 mm. or 1.587 mm. per second.[4] This movement was practiced for several hours prior to the actual experiments and could be made quite

[4] A drop of 3.175 mm. at the corner corresponded to an angle of 20 minutes from the vertical with the rocking plate as a centre.

even and continuous. The movement always started from the horizontal position,—the platform being righted between trials. The subject held in his lap a light piece of wood carrying two telegraph keys so mounted that the first and second fingers of the right hand operated the left and right keys respectively, while the thumb and other fingers grasped the edges of the base.

The subject was instructed to close his eyes at the signal "ready" keeping his head upright and as soon as he was certain of the direction in which he was being tipped to press the corresponding key. The movement began about one second after the signal. The lateral and longitudinal series were performed separately, so the subject had always a choice between two alternatives, right-left or forward-backward. The right key was for the right tilt in one series and for the forward tilt in the other.

An electric contact was made by the crank when the platform started from the normal position and another when the subject pressed his key. The time was recorded by an electric counter in series with a 10vd. tuning fork or by a 50th second stop watch operated magnetically. Thus the longer the time the greater the distance or angle of tilt and the poorer the discrimination of movement. A double throw switch put a telephone receiver in series with the wrong key so that mistakes were heard by the experimenter.

In one hour four short series were given, e.g., lateral, longitudinal, longitudinal, lateral, and the average of one and four compared with that of two and three, thus avoiding undue influence of practice and warming up. During the next hour with that subject this procedure was usually reversed, i.e., in the above example starting with longitudinal. In a given series the two alternatives were presented in a chance order determined by shuffling a pack of cards. There were 10 to 15 reactions in a series, that is 40 to 60 during an hour.

Table I summarizes the results. Each row represents one hour's work. The first column gives the subject. The second column shows which of the four short series was given first, e.g., "Longitudinal" means that the order on that day was longitudinal, lateral, lateral, longitudinal. The third column indicates the percent by which lateral discrimination is superior to longitudinal, i.e., the percent difference between the average of the two lateral series and the average of the two longitudinal in terms of either time or distance. The last column gives this difference divided by the probable error of the difference. In the results presented in the upper half of the table the

TABLE I

DETECTION OF LATERAL VS. LONGITUDINAL MOVEMENTS AT SLOW RATES

Subject	Order	% superiority lateral	Difference P. E. difference
An	Longitudinal	— 8	1.2
An	Lateral	65	6.6
Ap	Longitud nal	15	2.2
Ap	Lateral	— 4	0.4
B	Longitudinal	49	5.7
B	Lateral	32	6.0
C	Longitudinal	33	2.4
C	Lateral	4	2.5
O	Longitudinal	41	11.2
Sp	Longitudinal	37	2.7
Sp	Lateral	—13	1.7
An	Longitudinal	25	2.6
An	Lateral	30	2.9
Ap	Lateral	31	3.5
B	Lateral	14	2.7
C	Longitudinal	42	3.4
C	Lateral	7	0.8
O	Longitudinal	27	5.5
O	Lateral	6	1.9
Sp	Longitudinal	33	4.1
Sp	Lateral	13	1.6
Average		24.6	3.4

corner of the platform was lowered at the rate of 1.587 mm. per second and in the remainder at the rate of 3.175 mm. per second.

The general tendency of the results is obvious. Eighteen of the 21 series show a superiority in the detection of lateral movement, with an average superiority (including the negative values) of 25 percent. The differences are on the average 3.4 the probable error of difference. The mean variations (not given in the table) are slightly larger on the longitudinal than on the lateral, averaging 30 percent and 26 percent respectively. There are also more errors on the longitudinal than on the lateral,—17 percent of the total trials vs. 10 percent. The reactions to the lateral movements are obviously superior in all respects.

At the end of each hour's work the subjects were asked for introspection regarding the means by which they discriminated the movements, the comparative ease of the various judgments and anything else they may have observed. Specific questions were avoided in order to obviate undue suggestion

or the introduction of a different set or attitude toward the experiment.

The criteria involved in the perception of movement of this sort appeared to vary considerably with the different subjects. *An* relied mainly on the static senses. "I perceive the movement in the head; but sometimes I feel it all through the body." *Ap* on the other hand appeared more dependent on his tactual sensations. "Get sensations from back, seat or feet." The pressure of the chair against his shoulder was mentioned most frequently. However he noted having the head in a position in which he could feel them,—"a delicate adjustment which it was hard to get." He sometimes noted a "pure bodily movement which was not localized." *B* noted several factors. "Usually feel it up and down back and in the head. Feels like a pulling around the waist. Sometimes feel feet slipping or feel self slipping on the chair." The tactual criteria seemed more marked in the lateral and the "head" criteria in the longitudinal movement. *C* on the longitudinal felt the platform under the feet or the seat. On the lateral he felt "as if a stick right down through the body tipped." Later he localized the motion outside himself. "I feel stationary and the plane tips under me." *O* judged mainly by "tactual sensations from the chair and kinaesthetic sensations in the neck." Static senses did not seem involved. *Sp* noted for the lateral movement, "Feels like a dumbbell through the head and I wait and see which way ear goes. I feel it in the ear." The longitudinal movement was harder to describe although it seemed in the head also. When she relaxed, however, she felt it in the body, especially in the legs. Thus the perception of a change of equilibrium such as the above seems in general to involve both tactual and static senses. One subject seemed to utilize the former solely but the other subjects employed both.

A further point of interest is the comparison of the subject's estimate of his efficiency in the various directions with his actual efficiency. *An* was "more confident of the sideways judgments; the others lacked clearness." This corresponded to his objective results. *Ap* noticed no difference in his ability to make the various estimates. *B*'s introspection was equivocal, some days considering the lateral the easier and some days the longitudinal, with no correlation with objective efficiency. *C* felt consistently more efficient on the lateral as was actually the case. *O* sometimes noted one direction easier and sometimes the other and there was no correspondence with objective results. *Sp* consistently reported the longitudinal as much

more difficult and often unpleasant. However she tried to concentrate more on it and this sometimes reversed her objective results. Thus subjective estimates of ability to detect lateral vs. longitudinal movements do not correlate uniformly with actual ability.

In the results thus far described two rates were used, the interest being in the direction rather than the rate of movement. A few series were performed to test directly the effect of the latter variable. Trials at the two rates of 3.175 and .793 mm. per second lowering of the corner of the platform were intermixed in irregular order. The time of reaction and the distance tilted were averaged for the two speeds. On a given hour the trials were all lateral or all longitudinal.

Table II indicates the results briefly. Each row represents one hour's experiments. The first column gives the subject; the second the direction of movement; the third the percent superiority of the slow movement with respect to distance,

TABLE II

EFFECT OF DIFFERENT RATES OF MOVEMENT

Subject	Direction	Distance		Time	
		% superiority slow	Difference / P. E.	% superiority fast	Difference / P. E.
An	Lateral	72	5.9	132	6.8
An	Longitudinal	49	5.8	169	9.5
Ap	Lateral	54	4.9	160	7.3
B	Lateral	3	0.6	270	20.0
B	Longitudinal	23	2.8	224	9.5
C	Lateral	15	1.3	248	8.5
C	Longitudinal	195	10.7	36	4.3
O	Lateral	19	4.3	235	18.6
O	Longitudinal	—26	3.2	406	14.0
Sp	Lateral	212	7.7	27	3.1
Sp	Longitudinal	34	2.1	198	7.1
Average.....		59.0	4.5	191.3	9.9

i.e., the percent by which the average distance in the slow trials is less than that in the rapid; the fourth this difference divided by its probable error; the fifth the percent of superiority of the trials at the more rapid rate with respect to the time; and the last the ratio of this difference to its probable error.

It is apparent that one reacts more quickly to the more rapid movement but actually tips farther from the horizontal. Two of the subjects, *An* and *B* give introspection corresponding to this fact. However with the speeds used the time factor

is much more pronounced than the distance,—191 percent on the average as contrasted with 59 percent. A detailed table shows further that the mean variation is appreciably greater on the slow than on the quick movement,—the average of the percents mean variation being 33 for the slow movement and 25 for the rapid. More errors are made on the slow movement than on the rapid,—11 percent of the total number of trials as compared with 7 percent. Thus it would appear that under the above conditions reactions to the more rapid movement are more reliable.

A further study of the main problem was made with the other equipment. The procedure was identical with the above except that the heavy spiral springs released by the ratchet were used instead of the relatively slow turning of the crank by hand. Whereas in the previous method the subject's "*Aufgabe*" was more analagous to threshold judgment, here it was more like choice reaction. Only one rate was used,—a tension on the spring which lowered the corner of the platform 3 cm. in 150 sigma. The motion was negatively accelerated. An electric vernier chronoscope or a 50th second stop watch operated by a magnet recorded the time. When the pawl left the ratchet a circuit was broken thus starting the chronoscope and the subject stopped it. The subject closed his eyes and pressed both keys down at the signal "ready."

TABLE III

DETECTION OF LATERAL VS. LONGITUDINAL MOVEMENTS AT RAPID RATES

Subject	Order	Difference	
		% superiority lateral	P. E. difference
An	Longitudinal	7	2.0
An	Lateral	22	5.2
Ap	Longitudinal	18	2.5
B	Longitudinal	13	3.2
C	Lateral	3	0.6
H	Longitudinal	4	1.2
H	Lateral	7	2.5
L	Longitudinal	21	6.1
L	Lateral	21	6.3
O	Longitudinal	—10	3.2
R	Longitudinal	9	2.2
R	Lateral	10	2.3
Sw	Longitudinal	3	0.8
Sw	Lateral	15	3.6
Sp	Longitudinal	10	1.7
Average		10.2	2.9

The lever was thrown about one second later and the subject lifted the proper finger according to the direction of the tilt. The noise of the apparatus of course informed the subject that he had moved but it was a case of choice reaction and there was no appreciable auditory difference between the two directions. The times show that the reaction sometimes followed after the platform had come to rest in a tilted position and sometimes before.

Table III is similar in form to Table I and gives the percent by which the average lateral reaction time is quicker than the average longitudinal and the ratio of the difference to the probable error of difference.

The same tendency is here again manifest. The differences are not as large as in the preceding method but are about 3 times the probable error and average 10 percent in favor of the lateral movement. The mean variations (not given in the table) are almost identical but slightly larger in the longitudinal. There are, however, considerably more errors on the longitudinal,— 5.8 percent of the total trials as compared with 2.4 percent. The results thus agree with the previous in showing a superiority of the lateral reactions.

The introspection of the subjects under these conditions is similar to that under the previous. *An* felt the movement largely in the head and considered the lateral a bit easier. *Ap* found the quick movement "more general and not localized in one part of the body." *B* felt it in the chair or the head. *H* felt pressure on the chair and "sensations as if the stomach were shrinking away from the clothes." The former was the more pronounced. He seldom noted sensations in the head. *L* felt the lateral "in the ears." The longitudinal was felt in the stomach and secondarily in the ears. *O* as previously judged almost entirely by tactual sensations. *R* felt it "almost entirely in the ears." *Sp* felt "nothing but the jerk." *Sw* reported the lateral as a bit easier. In general the same criteria seem involved in the more rapid movement as in the slower.

The conclusion seems justified that the average individual tilted from a horizontal position can detect a change in the lateral direction appreciably more readily (10 to 25 percent) than a change in the longitudinal direction.

In the above results the left and right reactions were averaged together and compared with the average of backward and forward. A further problem suggests itself as to left *vs.* right and backward *vs.* forward, and accordingly the results for each subject were studied with this question in

mind. As to the lateral reactions there is no appreciable difference. Taking the results for a given day and tabulating the percents by which the reactions to a left tilt are superior to those to a right, the results are as follows. For the slow movement, produced by turning the crank, the average superiority of the left, including negative values is 4 percent; for the choice reactions to the movement produced by the contraction of the spring the average difference is 5 percent; for the reactions with the dep control (cf. infra)—5 percent, and with the stick control 2 percent. In all cases there is a fairly equal distribution of plus and minus values. Tabulating similarly the percents of superiority of perception of forward as compared with backward, the average difference for the slow movements is 19 percent, with about three-fourths of the values tending in the positive direction. The results are especially marked in the case of one subject. Likewise with the dep reactions 6 out of 7 cases show a superiority of the forward with an average of 7 percent. The difference disappears however in the choice reaction with the keys to the rapid movement and in the stick reactions, the average percents being only 3 and 1 respectively. The probable errors are rather high, of course, because of the smaller number of trials represented by each percent, but there is a suggestion that, with some individuals at least, perception of forward tilt is keener than that of backward.

The above results are what might be expected if one assumes a genetic explanation for perceptions of this sort. In daily life one's static organs are swayed laterally from the perpendicular very frequently, e.g. in walking. They are less often moved longitudinally. One often leans forward at a table, etc., but less frequently does he lean backward from the perpendicular. If repeated movements of the ampullar and vestibular organs in a given direction increase delicacy of perception of such movements, we should expect to find the keenest perception for lateral movements with left and right about equally efficient and perception of forward somewhat more delicate than that of backward movements,—a result which is obtained empirically.[5]

[5]A fact of possible interest in the development of tests for aviators is the correlation between lateral and longitudinal reactions. If the lateral and longitudinal averages for all the different hours of experiment are ranked, they correlate (foot rule) to the extent of .67 ± .09 for the slow movements and .76 ± .11 for the rapid movements produced by the release of the spring. That is, an individual who has superior ability in one direction has it in the other, and one's diurnal efficiency in the various directions varies concomitantly.

IV. *Dep vs. Stick Airplane Control*

There are at present two types of airplane control in quite general use, and it seemed worth while to determine if there was any difference in a person's reactions with the two types. In the ordinary dep control a wheel is mounted vertically on a post between the pilot's knees and is grasped with both hands. Turning the wheel clockwise as viewed by the pilot banks the left wing, i.e., tilts the machine toward the right and vice versa. Moving the wheel forward, i.e., moving the upright on which the wheel is mounted, lowers the nose of the machine and vice versa. In the other control a straight stick is mounted in about the same position as the dep and grasped with one hand. Moving the top of the stick to the right lowers the right side of the airplane, moving it forward lowers the nose etc. In both cases the direction of the machine is controlled by a foot bar.

These conditions were duplicated as nearly as possible on the tilting platform. Standard specifications were observed with regard to the distance from chair to foot bar and controls, height of bar relatively to seat etc., so that the subject was in a bodily position quite similar to that of an aviator during flight.

The lateral and longitudinal experiments were made on separate hours so that a remounting of the apparatus was possible. In each instance a lever was attached from the control to the top arm of a cross-shaped upright. This upright was pivoted at the center of the cross and two fairly heavy spiral springs were fastened from the ends of the horizontal arms to the base. The lower arm closed an electric contact under slight friction when the arm was on a dead center. The springs held the cross on center and the controls in a normal position (i.e., vertical) unless the latter were moved by the subject. For the lateral movement the dep and stick were connected by a system of levers so that they moved synchronously. For the backward and forward movement they were rigidly connected, the only difference in reaction being the use of two hands on the wheel *vs.* one hand on the stick.

The experiments were conducted in much the same manner as the preceding. The movement of the platform was the same throughout,—the corner dropped with negative acceleration 3 cm. in 150 sigma. Trials with dep and stick were intermixed in a chance order during an hour,—about 30 of each. The subject sat with his hands in his lap until the experimenter said "dep" or "stick." He then grasped the

control indicated and closed his eyes. A final signal "ready" was given one second before the release of the platform from the horizontal. Between trials he moved the control back to the normal position. In the lateral series using the dep he turned the wheel toward the high side, i.e., if he tipped to the left turned the wheel clockwise or when using the stick moved the top toward the high side. On the longitudinal series using either control the motion was toward the high

TABLE IV

DEP VS. STICK

Force (pounds)	Subject	% superiority stick	Difference P. E. difference
	H	—7.4	2.4
Dep.....7.10	L	0.3	0.1
Stick.....6.65	R	4.5	1.4
	H	3.9	1.3
Dep.....7.15	R	7.5	2.6
Stick.....6.65	Sw	—10.0	3.4
	Average	—0.2	1.8
	H	— 7.0	0.9
	H	—12.0	1.3
Dep.....12.0	L	3.4	0.9
Stick..... 4.0	L	15.0	2.0
	R	21.5	3.8
	Sw	30.0	5.6
	Average	8.4	2.4
	H	14.0	2.8
Dep.....20.0	L	10.2	2.1
Stick..... 5.5	R	49.0	7.4
	Average	24.4	4.1
Dep.....3.35	R	—10.8	3.7
Stick.....9.35	Sw	—20.6	5.1
	Average	—15.7	4.4
	B	— 3.7	1.9
Longitudinal....	B	— 2.7	1.0
Both equal.....	R	10.3	4.8
	R	6.5	2.0
	Sw	8.0	2.8
	Sw	— 0.6	0.2
	Sw	— 3.5	1.1
	Average	2.0	1.9

end, i.e., when tipping forward the control was pulled backward. These are the movements made in actual flight. On a given trial there was simply a choice between two reactions. A very slight motion of the control broke the electric contact so that the beginning of the reaction and not its extent was recorded. The reaction time from the beginning of the tilt until the movement of the control was taken by the vernier chronoscope or the 50th second stop watch. On the lateral motion there was one other variable involved, viz., the amount of force necessary to break the contact. This was varied by changing the arrangement of levers so that the stick required a force greater or less than or approximately equal to that of the dep.

The results are summarized in Table IV. The first column indicates the number of pounds force required to break each contact, measured by applying a spring scale at the point usually grasped by the subject. The second column gives the subject; the third the percent by which the average reaction time with the stick on a given hour is superior to (i.e., quicker than) that with the dep; and the last the ratio of this difference to its probable error. Averages are given for each combination of forces necessary to move the controls.

The table shows that when approximately the same force is necessary to break the contact there is no general tendency and the average difference is 0.2 percent. When the stick moves more easily the reactions are quicker,—when the forces are 12 and 4 lbs. averaging 8 percent quicker and when 20 and 5 lbs. 24 percent quicker. When the dep moves more easily the opposite result is found. In the longitudinal experiments indicated at the bottom of the table where the two forces are equal there is no significant difference as dep and stick are each superior in about half of the trials. A survey of the mean variation and the percentage of errors (not given in the table) shows nothing of interest except that in one group (dep 20 *vs.* stick 5.5) there is a considerably higher variation in general on the dep.

The following points of interest were mentioned in the introspection. *H* in series with the stick moving more easily than or the same as the dep thought the reactions with the former were quicker but more apt to be wrong. With the stick he would "hold still and the body would do the rest." However "the stick seemed to have more control than the dep." During the fore-period he had a kinaesthetic image of both movements. *L* liked the stick better and held it upright and let the body do the rest. After practice however

he preferred the dep. Moving the stick to the right was easiest but moving it to the left was more difficult than the dep. *R*'s introspection followed directly with the objective inertia of the controls. When they were equal he thought there was little difference in his reactions; when the dep had greater inertia he reported quicker reactions with the stick and vice versa. However the "dep seemed steadier, i.e., using my two hands." *Sw* had a feeling of greater certainty with the dep. "When I reach out and take hold of it I have greater confidence. Think involuntary movements play greater rôle with stick. Body naturally goes in reverse direction and takes dep with it but with one hand it might jerk away." The most interesting point in the introspective records was the feeling of greater confidence with the dep control.

The conclusion seems justified that there is nothing in the nature of the reaction with dep as contrasted with the stick control that gives one any especial advantage over the other, provided the same amount of force is necessary in each case to overcome the inertia of the mechanism. Where such a difference in force exists the control requiring the least force yields the quickest reaction time.

Prior to the experiments under the above instructions the subjects were given a few trials with each control with instructions such as the following: "Grasp the wheel with both hands; one second after the warning 'ready' you will tip either to the right or the left; make as quickly as possible the reaction that seems most natural." With two of the four subjects who were tried thus on lateral movement there was a very marked tendency with both controls to react toward the high side as in an airplane. With the third this tendency was present with the stick but not with the dep. He spoke of associations with driving an automobile. The fourth subject reacted toward the low side with both controls. He had ridden a bicycle considerably and was reminded of it immediately and on a bicycle one steers toward the low side to maintain equilibrium. Only two subjects were tried with similar instructions on the longitudinal movement. They reacted immediately with both controls toward the high end. Thus it would seem that the types of reaction used in the standard airplane control are those which are more or less instinctive with the average individual and hence most readily automatized.

V. *Conclusions*

If an individual sitting in a chair on a platform which rocks about a point below its center is tilted from the horizontal

slowly at a constant rate until the direction is perceived, or performs a choice reaction to a rapid tilt with negative acceleration, (the type of movement experienced in an airplane). the perception of the lateral is considerably superior to that of the longitudinal movements. A forward tilt is slightly more readily perceived than a backward. This indicates that an aviator is slower in perceiving and correcting a pitch of his machine as contrasted with a roll. Hence in the selection or arrangement of airplane controls if those for one direction are to be more readily manipulated such should be used for longitudinal control to compensate the aviator's natural slowness in detecting a longitudinal motion.

When tilted at various rates (without acceleration) the direction is perceived more quickly at the faster speeds but one actually tips through a greater angle. However the time factor varies much more with change of speed than does the distance factor.

Judging by the introspection both tactual and static senses are involved in perceptions of this sort. Subjective estimates of efficiency under the various conditions do not correlate uniformly with objective results.

In reacting to sudden changes of equilibrium with standard dep and stick airplane controls there is no appreciable difference in the reaction times when the forces necessary to overcome the inertia of the mechanism are equal. Where such differences in force exist the reaction time is slower with the control possessing the greater inertia.

THE APPLIED PSYCHOLOGY OF HUGO MÜNSTERBERG

By Henry Goldman, New York City

I. *Introduction*

The experiments of Hugo Münsterberg in applied psychology, due to his prominent position in the field of psychology and pedagogy, have received widespread and marked attention, and it is now proposed to examine them critically as they are presented in his book: *Psychology and Industrial Efficiency*. These experiments—for motormen, for the ship service, and for telephone operators,—will be discussed, objectively and subjectively, with reference to aim, purpose, working hypothesis, historical account, means, modus operandi, results, explanation of results, and conclusions.

"Our aim," writes Münsterberg,[1] "is to sketch the outlines of a new science which is to mediate between the modern laboratory psychology and the problems of economics." "Only in the last ten years do we find systematic efforts to apply the experimental results of psychology to the needs of society."[2] This lack of application of experimental results to practical life is different from what happened in physics, chemistry, medicine, agriculture, mining, and transportation.[3] Psychologists felt reluctant to apply their knowledge because, first, they thought that the science was not firmly enough established, and second, they were absorbed in formulating general laws. The result is that we know the working of the typical mind. In practical life we never have to do with what is common to all human beings,—we have to do with personalities whose mental life is characterized by particular traits of nationality, race, vocation, sex, age, or special interests. The study of individual differences was the most important advance toward the practical application of psychology.

Applied psychology, or psychotechnics, is not concerned with the *necessity of solving* a given problem, any more than an engineer is concerned with the need for a bridge at a given spot. His task is merely that of *solving* the problem. We can

[1] Page 3.
[2] Page 5.
[3] Page 8.

attack a psychotechnical problem in two ways: first, by studying the various human mental processes and asking for what end each mental factor can be practically useful; and second, by noting the various ends acknowledged in our society and then seeking the various psychological facts to realize these ends.[4] Or simply, the three chief purposes of business life are, first, to find the men whose mental qualities make them best fitted for the work which they have to do; second, to discover under what psychological conditions we can secure the greatest and most satisfactory output of work from each man; and finally, to determine, how we can produce, most completely, the influences on human minds which are desired in the interest of business. "In other words, we ask how to find the best possible man, how to produce the best possible work, and how to secure the best possible effects."[5] "The economic task with which we want to demonstrate the new psychotechnic method is the selection of those personalities which by their mental qualities are especially fit for a particular kind of economic work."

Present-day tests by examinations, diplomas, letters of recommendation, eliminate only the entirely unfit. This is only a negative selective process; it keeps out the unfit but does not necessarily place the fit. Social statistics show with appalling clearness what a burden and what a danger to the social body is growing because of the number who do not succeed and who by their lack of success become discouraged and embittered.[6] Münsterberg concludes that the careful selection of individual and mental characters for the various tasks of the world will insure not only greater success and gain but, above all, greater joy in the work, deeper satisfaction and more harmonious unfolding of the personality.[7]

Again, we must find what demands are made upon the mental system, and we must grade these demands. For the most important ones we must seek exact standards and experimental methods. He describes two methods of attack: first, by testing as a whole the mental process demanded by the industrial work, that is, the total activity should be performed in a gradual, measureable way; and second, by resolving the mental process into its components and testing every single elementary function in its isolated form. In the first case special apparatus must be constructed; in the second case, the psycho-

[4]Page 23.
[5]Page 27.
[6]Page 38.
[7]Page 59.

logical laboratory can use the familiar apparatus and methods. In certain industrial activities a series of psychical factors is in question which do not fuse into a total united process. In many industrial tasks just this unity is the essential condition. The testing of mental elements in such cases would be as insufficient as if we were to test a machine with reference to its parts only and not with reference to its united performance. As an illustration of the first method of attack Münsterberg presents his experiments on motormen; as an illustration of the second method, that is, the analysis of activity and testing the elementary functions, he gives the case of testing telephone operating.

II. *Objective Report*

1. *Tests for Motormen. Problem.* Trolley car accidents have always aroused disquietude and even indignation in the public mind. Street railway companies have suffered much from indemnities amounting, in some companies, to 13 per cent of the gross earnings, and the accident cases of some corporations are as many as 50,000 per year. In 1912, the American Association for Labor Legislation held a convention to discuss accidents and their prevention, and asked Münsterberg to investigate means of selecting desirable employees.

Working Hypothesis. Münsterberg found that the reaction time of motormen who had few accidents and those who had frequent ones was not much different. Sharpness of vision is examined before entrance into service and this factor eliminated. He thought the mental process to be a particularly complicated act of attention by which the manifoldness of objects, the pedestrians, the carriages, and the automobiles are continuously observed with reference to their rapidity and direction in the quickly changing panorama of the street. He thought there are two types of men; one who waits for nearby objects to cross, and one who gets easily fatigued and while fixating a distant carriage overlooks the nearby pedestrian. Miniature apparatus would be inappropriate: feelings, ideas, and volitions would be aroused which have little in common with the processes of actual life.[8] "The essential point for the psychological experiment," Münsterberg said, "is not external similarity of apparatus but exclusively the inner similarity of the mental attitude. The more the external mechanism with which or on which the action is carried out becomes schematized, the more the action itself will appear in its true character."

[8]Page 69.

Historical Account. Münsterberg mentions no previous experiments of this sort.

Means. (*a*) *Material.* A card, 4½ in. by 26 in. is divided into half inch squares, and represents the street. The central column is the track and the four columns on either side of the track are marked with red and black figures: 1, 2, or 3. One denotes a pedestrian who moves one step; two denotes a horse who moves twice as fast, and three denotes an automobile moving at three times the speed of a pedestrian. Black digits move parallel to the track while red ones move across and are dangerous. A red 3 which is three units away from the track, or a red 2, two units away, or a red 1, one unit away will land on the track, and the aim is to find these points quickly. A red 3 four units away is harmless, as well as a red 3 two units away. The black figures, as well as the red ones too far or too near, confuse the operator.

Twelve cards, one under another, were pressed from below against a glass plate. The plate lies in a black wooden box and is completely covered with a black velvet belt 8 in. broad, moving over cylinders at the front and rear ends of the apparatus. In the center of the belt is a glass window 4 ½ in. by 2½ in. If the front cylinder is turned by a crank the belt passes over the glass plate and the window moves over the track, revealing five units of track, full width (nine squares). A second window appears when the first has completed the card, so that the entire twelve cards can be used without interruption.

(*b*) *Subjects.* These were of three kinds: first, a number of the best motormen, who had spent twenty years or more in service, with few or no accidents; second, a large number of men with bad records; third, some whose records were neither especially good nor especially bad.

Methods. These were individual, with recorded observations.

Modus Operandi. A careful, quiet, practical explanation of the device was given, showing the test card outside the machine. Then followed a preliminary test, in which attention was called to each mistake. This procedure was repeated until the rules were completely mastered, and required only a few minutes. The motormen who took the test agreed that they really passed through the experiment with the feeling which they have on a car.[9]

[9]Page 74.

Scoring. The shortest time for a complete test was 140 seconds; the longest, 427 seconds. Counting 10 seconds as the equivalent of one mistake, then a man with a record of 270 seconds and 2 mistakes would have a score of 290.

Results. Old well-trained motormen came to 450, which was the average. The best result was 290. 350 to 450 was considered fair; 450-550 mediocre; and over 550 very poor.

Experiments with highly educated graduate students at Harvard engaged in research work, showed much better results than those with the motormen. The scores of these students ranged from 233 to 275.[10]

"The results show a far-reaching correspondence between efficiency in the experiment and efficiency in actual service."[11] "If various interferences are taken into account, the correspondence between efficiency and the results of the tests is fairly satisfactory."[12]

Explanation of Results. The Company selected model men, but 20 to 30 years' service make them rather old men, who have no longer the elasticity of youth and are less able to think themselves into an artificial situation like this experiment. Other mental traits than ability to foresee danger points may become causes of accidents, such as a daring spirit, one who is undisciplined or one not sufficiently acquainted with local conditions. Such may show accidents and yet pass a good test. Men enter tests under a certain nervous tension and therefore may not perform as well as their mental equipment should allow.[13]

Conclusions. Motormen with more than 20 mistakes should be excluded. With a score of less than 350, mental fitness is very high; 350 to 450 is fair; more than 550 not acceptable under any conditions. A test of ten minutes would be sufficient to exclude perhaps one fourth of the number nowadays accepted as motormen. "These 25 per cent are not careless, they do not act against instructions, but their psychical mechanism makes them unfit for that particular combination of attention and imagination which ought to be demanded for the special task of motorman."[14]

2. *Tests for the Ship Service. Problem.* An officer on the bridge of a ship may bring thousands into danger by one

[10] Page 80.
[11] Page 74.
[12] Page 77.
[13] Page 76.
[14] Page 81.

single slip of his mind. All officers know what should be done, but too many do not react in an appropriate way, when an unexpected combination of factors suddenly confronts them. Three types of officers are enumerated:

(1) The officers who are almost paralyzed when dangerous conditions suddenly threaten—they vacillate and remain inactive until it is too late to give the right order;

(2) The officer who feels only a necessity for rapid action and without clear thought acts according to the first idea which enters his mind;

(3) The officer who quickly reviews all the factors, weighs their relative importance, and with almost instinctive certainty comes to the same conclusion which he would have reached after longer deliberation.

Working Hypothesis. Münsterberg was convinced that the mental process of decision in a complicated situation, especially the rapidity, correctness, and constancy of the decision, could be made accessible to measurement by means of an artificial device.

Means. (*a*) *Material.* The material for the test consisted of twenty-four cards of the size of playing cards. On the upper half of every one of these cards there were 4 rows of 12 capital letters, namely A, E, O, U, in irregular repetition. On 4 cards one of these vowels appears 21 times, and on each of the others 9 times; on 8 cards one vowel appears 18 times and each of the 3 others 10 times; on 8 cards one vowel appears 15 times and each of the others 11 times; and finally, on 4 cards one vowel appears 16 times, each of the 3 others 8 times and besides them 8 different consonants are mixed in.[15]

(*b*) *Subjects.* Münsterberg states simply that the experiment was performed on "many persons," probably students, judging from his reference on page 93.

Modus Operandi. The person tested has to distribute these 24 cards as quickly as possible into 4 piles, so that in the first pile the letter A is most frequent, in the second the letter E predominates, and so on. The result must never be secured by counting the letters, because this would delay the decision. Time is measured in fifths of a second, from the time the first card is picked up until the last is put down.

A preliminary test is given to determine the time for ordinary sorting. Twenty-four cards, on each of which one letter: A, E, O, or U was printed once, were sorted into 4 piles.

[15]Page 87.

The average time was 20 seconds, some taking 18 seconds, and only very slow persons needed more than 25 seconds. This maximum range of 10 seconds was regarded as unimportant because the variations in the experiment amount to more than 200 seconds.

In performing the experiment "some men lose their heads entirely, it is a painful activity for which they require a long time. Some letters stand out and appear predominant, but the next moment the attention is drawn to some other letters which appear to be in the majority. Other subjects distribute the cards in piles at relatively high speed, but the measurement of results shows many errors which would have been improbable after quiet consideration. Others, still, carry out the experiment quickly and with few mistakes, and with a feeling of an agreeable and stimulating mental activity. In all cases the subjects feel themselves under the unified impression of all 48 letters together."

Scoring. Less than 80 seconds was considered quick; 80 to 150 seconds, moderately quick; 150 to 250 seconds, slow and deliberate; 250 and over was too slow for quick action. When one letter appears 21 times and the 3 others only 9 times, the decision should be easier than when the predominant letter appears 15 times and the 3 others each 11 times. The value 4 was given to mistakes where the letter appears 21 times, value 3 was assigned to a mistake in the 18-letter cards, 2 for the 16-letter cards and 1 for mistakes in the 15-letter cards.

A sum below 5 signifies a very safe and perfectly reliable ability for decision; 5 to 12 satisfactory, 12-20 uncertain; and over 20 very poor.

To allow for both, time and mistakes, multiply the sum of the calculated mistakes by the number of seconds. If the product of the two figures is less than 400, it may be taken as an indication of perfect reliability.

Between 400-1000 indicates decisions are normal and very satisfactory.

Between 1000-2000 indicates decisions are not good but still adequate.

Between 2000-3000 indicates decisions are unreliable.

Over 3000 indicates reliability is practically absent.

Results. Among advanced students in the research laboratory the product of mistakes and seconds varied between 348 and 13,335. The lowest record, 348, was the product of 116 seconds and 3 mistakes. The aim was to compare the results of the experiment with the experiences of the various indi-

viduals which they themselves reported concerning their decisions in unexpected, complicated situations, and also with the judgments of their friends, who were asked to describe what they might expect from the subjects. The coincidence of the results with the self-characterization is frequently quite surprising.[16] "The results of the experiment in sorting the cards confirmed this self-observation in such frequent cases that it may indeed be hoped that a more extended test of this method will prove its practical usefulness."[17] It should be adapted, not only to the ship service, but also to railroading and other industrial tasks.

Conclusion. "It is clear that the real proof of the value of this method cannot be offered. This is just the reason why we selected this illustration as an example of the particular difficulty."[18]

3. *Tests for the Telephone Service. Problem.* Fourteen separate psychophysical processes are necessary in a typical telephone operator's work on one telephone call. A telephone girl cannot handle satisfactorily more than 225 calls in an hour. In extreme cases this number may rise to 300. For short periods there may be a demand for 10 calls per minute. Normally 150 calls per hour fall to each girl. The work requires a rapid, subtle activity at high tension. During the first half year, one third of those who originally entered, leave the service. They have wasted their time and energy in an attempt to learn a kind of labor which they cannot apply elsewhere, and the company has lost the salary it paid them while learning. The Bell Company employs 16,000 operators, so the problem would be a profitable one to solve.

Working Hypothesis. Münsterberg decided to resolve the activities at the switchboard into their elements and undertake the experimental testing of a whole series of elementary mental dispositions. These dispositions he resolved into three: attention, memory, and intelligence. Of intelligence, he says, "The newer pedagogical investigations speak in favor of the view that besides all special processes, or rather above all of them, an ability must be recognized which cannot be divided any further, and by which the individual adjusts his knowledge, his experiences, and his dispositions to the changing purposes of life."[19]

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[16]Page 94.
[17]Page 95.
[18]Page 92.
[19]Page 103.

Means. (*a*) *Material.* This consisted of a newspaper, some writing paper, pencils, and 48 cards.

(*b*) *Subjects.* These were 30 girls recently admitted to the telephone school whose age varied between 17 and 23 years.

Methods. These were partly individual examinations and partly group tests.[20]

Modus Operandi. Group Tests. (1) *Memory Test.* This consisted of reading to the whole class, at first 2 numbers of 4 digits, then 2 of 5 digits, then 2 of 6 digits, and so on up to figures of 12 digits, and demanding that they be reproduced as soon as a signal was given.

(2) *Attention Test.* This consisted of crossing out a particular letter in a connected text. Every woman in the class received the same first page of a newspaper of that morning. The newness of the content was expected to distract attention. At a certain time a bell was sounded and each girl was expected to start a new column. The object was to discover how many correctly crossed letters were done, how many overlooked, and how recognition and oversight were distributed.

(3) *Intelligence Test.* This consisted of reading a series of 24 pairs of words, taken from the sphere of the experience of the girls, of which the two members always logically belong together. Later one word of the pair was read, and the girls were requested to write the word which belonged with it in the pair. The results were compared with the rank of the girls as estimated by their teachers from experience with them as students.

(4) *Space Perception.* This test consisted of dividing first the long and then the short edge of the folio sheet into two equal halves by a pencil mark.

Individual Tests. (5) *Rapidity of Movement.* This was tested by causing the student to make, with a pencil on paper, zigzag movements of a particular size during 10 seconds from one signal to another.

(6) *Sorting Cards.* A pack of 48 cards were sorted into 4 piles as quickly as possible. The time was measured in fifths of a second.

(7) *Accuracy of Movement.* This test was performed by trying to reach, with the point of a pencil, 3 different points on the table in the rhythm of metronome beats. On each of the three places a sheet of paper was fixed with a fine cross in the middle. The pencil should strike the crossing point. One

[20]Page 101.

demanded the full extension of the arm; the other two had to be made with half-bent arm. This test was introduced because the hitting of the right holes is important in switchboard work.

(8) *Association Test.* Six words, like "book," "house," "rain," were called, and the student was expected to reply with the first word which came into her mind; the time was measured in fifths of a second.

Results. (1) *Memory Test.* It is useless to consider those with more than 10 digits. Münsterberg took only those with 8, 9, or 10 digits. There were 54 possible mistakes. The smallest number of actual mistakes was 2; the largest, 29.

(2) *Attention Test.* In the attention test, some crossed out many "a's" and overlooked many; some overlooked few but crossed out less than others; some did poor work at first but soon reached a high level; others did good work at the beginning but became slow and careless. There was much fluctuation of attention.[21] The smallest number of correctly marked letters was 107; the largest number was 272. The duration of the test was 6 minutes. The smallest number of overlooked letters was 2; the largest number was 135, which was quite isolated, however. The errors of letters wrongly cancelled varied between 5 to 60. The best results were a case of 236 letters marked and only 2 overlooked, and a case of 257 marked with 4 overlooked.

(3) *Intelligence Test.* The highest number of words reproduced was 22 out of a possible 24. Smallest number of words remembered was 7.

(4) *Space Perception.* The range of mistakes was between 1 and 14 millimeters.

(5) *Rapidity of Movement.* No report.

(6) *Sorting Cards.* The time varied between 35 and 58 seconds.

(7) *Accuracy of Movement.* Many could not perform the movement quickly enough.

(8) *Association Test.* The time for the 6 words varied between 9 and 21 seconds.

The grades of each girl for each experiment were calculated. The same candidate, for example, stood 7th in memory, 15th in letters marked, 3rd in letters overlooked, 21st in word pairs grasped, 11th in reference to exactitude of space perception, 16th in association time, and 6th in sorting cards. The

[21] Page 102.

average of all the grades of each girl was then taken, and the girls arranged in order of rank.

The results of average standing in the tests compared with average standing in school after 3 months was on the whole satisfactory.[22] The telephone company had mixed with the class a number of women who had been in service a long while and had even been selected to teach in the telephone school. These women stood at the top of the list. Correspondingly, those who stood lowest in psychological rank had in the meantime been found unfit in practical service and had left the company. The agreement was not perfect. One of those low in rank was doing fair work, and two of those high in rank were reported to be only fair by the telephone officials.

II. *Subjective Report (Criticism)*

Aim. This work of Münsterberg's is one of the first attempts to "place the psychological experiment systematically at the service of science and industry,"[23] as its author proclaims, and it promptly devotes itself to two low grade occupations: motorman and telephone operator, if pay is a fair criterion. The author informs us that "the careful selection of individual mental characters for the various tasks of the world will insure not only greater success and gain but above all, greater joy in the work, deeper satisfaction, and more harmonious unfolding of the personality."[24] How can this be possible? Can people take great joy in their work and attain more harmonious unfolding of the personality on low wages, even if that is all that vocational guidance allots them?

Working Hypothesis. "The essential point for the psychological experiment is not the external similarity of apparatus but exclusively the inner similarity of the mental attitude. The more the external mechanism with which or on which the action is carried out becomes schematized, the more the action itself will appear in its true character." First, this is contrary to the doctrine which is basic for all scientific research: *no conclusion is valid which does not study the conditions under which the results are obtained.* Münsterberg admits this himself when he says, "The chief danger, moreover, lies in the fact that those who are not accustomed to psychological research are easily misled. They fancy that such an experiment can be carried out in a mere mechanical way without careful study of all the conditions and accompany-

[22] Page 108.
[23] Page 3.
[24] Page 38.

ing circumstances. Thereby a certain crudeness of procedure may enter which is not at all suggested by the test method itself. The psychological layman too seldom recognizes how many other psychic functions may play a rôle in the result of the experiment besides the one which is interesting him at the moment. The well-schooled laboratory worker almost automatically gives consideration to all such secondary circumstances. While his experiments may refer to the process of memory, he will yet at the same time carefully consider the particular situation as to the emotional setting of the subject, as to his attention, as to his preceding experience, as to his intelligence, as to his physiological condition, and many other factors which may have indirect influence even on the simplest memory test."[25] The quotation is an almost perfect statement of the problem of scientific research, but Münsterberg himself promptly forgets to consider the persons upon whom his experiments are performed, with regard to emotional setting, attention, preceding experience, intelligence and physiological condition. In the motorman test, for example, he apparently neglects the factor of attention entirely, because in the laboratory the motorman is not disturbed by sounds, colors, or moving objects which might distract his attention on a trolley car. And with regard to intelligence, in his telephone tests he himself states that "the newer pedagogical investigations speak in favor of the view that besides all special processes, or rather above all of them, an ability must be recognized which cannot be divided any further, and by which the individual adjusts his knowledge, his experiences, and his dispositions to the changing purposes of life."[26] In the motorman test the worst college student made a better record than the best motorman. The inevitable conclusion is that either this test is an intelligence test, pure and simple, or else college men should become motormen. We fancy there will be no great rush by college graduates to supplant the present occupants of the motorman's box.

Means. (1) *Material.* The material is adequately described.

(2) *Subjects.* The subjects are not described with much detail. In the ship service tests they are merely mentioned as "many persons."

Methods. Individual tests are more valid than group tests. Münsterberg uses individual tests throughout except in the

[25] Page 114.
[26] Page 103.

first four tests for the telephone service. But, the lack of records in complete form, as discussed later, nullifies in this case the superiority of the individual tests over the group tests.

Modus Operandi. The chronology of the tests is completely lacking. The plan of each test is given with complete detail, and is probably the best part of Münsterberg's work. The material is uniform for each test. The execution is discussed with sufficient detail in all cases except where he states that "the motormen agreed that they really pass through the experiment with the same feeling which they have on the car."[27] A feeling is an indefinite quantity, and it is questionable, in view of the discussion above, whether the statement of the motormen is correct. The scoring is elaborate and carefully thought out. The records are not given completely enough with regard to quality and quantity, and the presentation of what is given is merely in descriptive form. There are no tabular or graphic records.

Results. The validity of the results is questionable, always, when records of experiments are presented in so fragmentary a manner, since the student has no way of exercising his judgment in verifying the validity of the results. For instance, in the ship tests, we are told that "the coincidence of results (of experiment) with self-characterization is frequently quite surprising."[28] It would be interesting, to say the least, to have the original data! Or, in the motorman tests, we are told that "if various interferences are taken into account the correspondence between efficiency and the results of the tests is fairly satisfactory,"[29] and that "the results show a far-reaching correspondence between efficiency in the experiment and efficiency in actual service."[30]

Explanation of Results. There is no explanation of the results in the ship service and telephone girl tests. In the motorman tests Münsterberg virtually admits that the test he used is valueless to satisfy his aim, which was to eliminate accident. He says, "Other mental traits than ability to foresee danger points may become causes of accidents, such as a daring spirit, one who is undisciplined or one not sufficiently acquainted with local conditions. Such men may show accidents and yet pass a good test. Men enter tests under a certain nervous tension and therefore may not show so well as their mental equipment should allow."

[27] Page 74.
[28] Page 94.
[29] Page 77.
[30] Page 74.

Conclusions. In the ship service and telephone tests Münsterberg draws no conclusions, but the motorman tests, he claims, will enable us, in a 10 minute test, to exclude one fourth of those nowadays accepted as motormen, whose "psychological mechanism makes them unfit for that particular combination of attention and imagination which ought to be demanded for the special task of motorman."[31] If his device is considered legitimate for the purpose of his test, in spite of the belief that it does not reproduce the actual surroundings and working conditions of a motorman's task, then the statement just quoted should be convincing of its failure, because what is this but an acknowledgement that the cause of the elimination of one fourth of the men would be their sheer lack of intelligence!

The reader's conclusion after a study of the tests, inevitably becomes that the most significant factor in all tests is intelligence. The conclusion is, also, that most of the tests measure the intelligence of the individual rather than any other of his characteristics. And finally, may not we add that the diagnosis of the individual's ability to succeed is correct in direct ratio to the amount of intelligence which he possesses and registers in the experiment!

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WORK OF THE COMMITTEE ON CLASSIFICATION OF PERSONNEL IN THE ARMY

EDWARD K. STRONG, JR.

Purpose of Personnel Work.—True efficiency in war, as in industry, consists largely in getting men into the right places—in assigning them to those positions where each can serve with greatest effectiveness. Owing to differences in experience, technical skill, specific training and temperament, a man may be worth in one position many times what he is in another. Intelligent personnel work is intended to match each man's abilities with his task, to place him in that position where he is most valuable.

Progressive industrial concerns now appreciate the necessity for special departments to exercise this direction over their employees in order that they will be of greatest value to the company.

When war was declared, the Secretary of War and The Adjutant General recognized the necessity for determining the abilities of the drafted men of the Army in order to place them where they could serve most effectively. The construction expert, for instance, is needed in the Engineers, not in the Cavalry; the drill press operator in the Ordnance, not in the Quartermaster's Department; the map maker in the Signal Corps, not in the Infantry.

The task of analyzing the men, of classifying them by trade and by specific occupations within the trade, and of assigning them to those branches of the service and to those positions in the regular infantry divisions where they can serve best—this task was assumed by The Adjutant General with the assistance and co-operation of The Committee on Classification of Personnel in the Army.

The Committee.—The Committee on Classification of Personnel in the Army is a civilian body created by the Secretary of War on August 5, 1917, and working under the jurisdiction of The Adjutant General. Its general function has been to furnish counsel and to carry on research work concerning personnel problems.

The Committee has been composed of psychologists interested in individual differences and of employment managers.

The Director of the Committee is Dr. Walter Dill Scott, Director of the Bureau of Salesmanship Research at Carnegie Institute of Technology, Pittsburgh, Pennsylvania. It has had in its service for longer or shorter periods of time the majority of the leading employment managers in the country. And it has used in addition the services of many prominent sales managers, specialists in job analysis, and statisticians.

The Committee acts in an organizing and advisory capacity. Its relation to the Army is much the same as that of an Expert Public Accountant called in by an industrial concern to install a new system of bookkeeping. When the system is installed and properly operating in an Army Division, and when the Military Officers are thoroughly trained to assume full charge, the Committee withdraws and leaves its operations entirely in the hands of the proper military authorities, except so far as the Secretary of War and The Adjutant General may retain its services as a business house will retain the services of the public accountant after his system has been installed in order to make sure it continues its functions properly.

The Personnel Work.—Through the instrumentality of the Committee, an organization has been built up in all the army divisions in this country by which all enlisted men and commissioned officers are classified according to their occupational qualifications and also in the case of commissioned officers according to their military qualifications. The cards upon which these records are entered are filed for the enlisted men in a Division Personnel Office and for the officers in the office of the Commanding General of the Division. Because of this system, thousands of men have been assigned to specific work in the army for which their previous experience especially fitted them. A good example of this service comes from one of the Southern cantonments. A Colonel of a regiment of engineers came to the Division Personnel Officer for help in finding a man for the most responsible position an enlisted man can fill, that of Regimental Sergeant Major. The Colonel was looking for a mature man of commanding presence and force of character, with military experience. He wanted some one who had had clerical experience, preferably as an accountant, and who also had had engineering training. The Personnel Officer found him a man who met even these varied specifications. As a lad this man had enlisted in the Navy and risen to the rank of Machinist's Mate. He had then left the Navy and worked for two years or so as a stenographer and bookkeeper; and at the time of his enlistment in the National Guard Army last fall he was a senior in the Engineering School of

Tulane University. Moreover, he was a *private in that Colonel's own regiment.*

Up to the present time a man has been classified on the basis of a personal interview. The interview was first conducted by the company commander, but after a fair trial that procedure was discontinued. It is now made by officers who have been especially instructed for this work and are referred to as members of the interviewing Board. This system has given very satisfactory results. In one transfer of 800 men to a Pioneer regiment it was estimated that 97% of the men came up to the specifications of the Colonel. But in some cases where specialists were needed the system has not worked so well.

The Trade-Test Division.—In order to improve still further the system it is contemplated to establish in each cantonment *trade-tests.* A series of carefully graded questions are being selected in such a way that a novice will be unable to answer any of the questions, an apprentice a few only, a journeyman most of the questions, and an expert all of them. In addition, performance tests are being developed so that the interviewer's estimate of the man's fitness along any occupational line will be based upon actual demonstration of his handiwork. A small hand book, "Aids for Interviewers" (Form T. T. 1., Preliminary Edition), prepared by Mr. Mark M. Jones, has already been distributed to Personnel Officers. Two groups of experts are being employed in the Trade-Test Division of the Committee on this work—the first in developing the questions and tests on the basis of the best sources of information available in the country; the second devoting its energies to careful and painstaking try-outs of the tests upon groups of apprentices, journeymen and experts so as to ascertain just how they work out in practise.

Another phase of the work of the Trade-Test Division has been the development of a book, "Trade Specifications," by Mr. J. J. Swan, which gives an exact comprehensive definition of some 600 different trades together with a statement of the trades which can be drawn upon as substitutes. A comprehensive index to this book makes it possible to locate, regardless of the term that may first be thought of, any one of the specifications. A simpler index is also furnished Personnel Officers for reference when interviewing men. This index of occupations has become the standard list of terms by which occupations are referred to by all army personnel officers, particularly when submitting requisitions to the War Department.

Tables of Occupational Needs of Units in a Division.—In

order that Divisional Personnel Officers may be more thoroughly informed as to just what types of skilled and semi-skilled men are needed in the various units of a division a series of tables have been prepared showing just what each unit requires. For example, Table 23-b shows the needs of a radio company of a Field Signal Battalion. In one column is given the various grades and duties of the 75 men according to the Tables of Organization and in a paralell column is given the civil occupation which most nearly fits the man to undertake the military duty, thus:

Table of Organization	Skilled	Partly Skilled	Occupation and Code
1 Master Signal Electrician	1		Radio Operator and Constructor (31 w plus wc) plus engineering knowledge
6 Sergeants, 1st Class			
1 First Sergeant			
5 Chiefs of Sections	5		Radio Operator (31 w)
9 Sergeants			
1 Mess Sergeant	1		Caterer (40 c)
1 Supply Sergeant	1		Merchant or stockkeeper (42, 18 s)
7 Company Duty	7		Radio Operator (31 w)
15 Corporals			
(1 Company Clerk)	1	1	Clerical worker who can tpye-write (35 g plus 39 t)
	1		General mechanic with small apparatus experience (6 mc)
12 Company Duty		12	Radio operator or Telegrapher (31 w, t)
	etc.		

These tables represent a vast amount of work, being based on the reports of many officers in Washington and in the field, including French and English officers. Dr. W. V. Bingham is largely responsible for this present form.

Extension of Work to Staff Corps.—This personnel work is rapidly being extended to the Staff Corps troops. On March 10th, the system was in operation in the Coast Artillery, a large part of the Quartermaster Corps, including 2,000 civilians at Washington, portions of the Signal Corps, and plans were being made for similar work in the Ordnance Corps. It is expected that the system will be completely installed in the Quartermaster and Signal Corps in a very short time. Representatives of the Committee in Europe are planning for its adoption throughout those units of the army in France which sailed before the system was installed in them.

Central Personnel Bureau.—In conjunction with the occupational classification of enlisted men there has been estab-

lished in Washington a Central Bureau which receives reports twice a month as to the number of skilled and semi-skilled men in each occupation, in the National Army, National Guard, and the Regular Army camps. This Central Bureau has furnished the information as to where skilled men were to be found in the army on the basis of which the General Staff has organized a large number of technical units for such assignments; 109,487 men have been individually selected by Division Personnel Officers on the basis of their occupational fitness. Of this number 59,793 have been handled through the Central Bureau since its establishment. These totals do not include requisitions for men which did not specify occupational or military qualifications.

This number includes over a hundred capable physicists and meteorologists imperatively needed by the Aviation Section; chemists for gas defense work; surgical instrument repairmen; bacteriologists (including one of the ablest men in America for the particular duties required of him by the Sanitary Corps in France); refrigeration experts for the food service of the Quartermaster Corps; 5,000 mechanics and technicians for the Aviation service, and two-thirds that number for the Land Division of the Signal Corps; 480 crane operators, 1,230 foresters, and thousands of railroad builders, railway shop mechanics, and other workmen for Engineer regiments already overseas; 1,600 accountants, inspectors, machinists, gunsmiths and other ordnance specialists; 275 French-speaking chauffeurs; and an entire regiment of 2,600 French-speaking men for Army Headquarters, to serve mainly as military police.

The Central Bureau has also compiled statistics showing the resources of the army along occupational lines. These figures have called attention to shortages along certain lines, such as, airplane mechanics, auto repairers, blacksmiths, canvas workers, farriers, gas engine repairmen, harness makers, etc.

Committee on Education and Special Training.—In order to meet these deficiencies through the technical training of men a Committee on Education and Special Training was appointed by the Secretary of War on February 10. The Committee is composed of Col. Hugh S. Johnson, deputy provost marshal general; Lieut. Col Robert I. Rees, of the General Staff; and Major Grenville Clark, of The Adjutant General's Department.

The five advisory members of the Committee are: Dr. Charles R. Mann, of the Carnegie Foundation for the Advancement of Teaching and the Massachusetts Institute of Technology; Dr. James R. Angell, of Chicago, Dean of the faculty

of the University of Chicago; Mr. J. W. Dietz, of Chicago, Director of Education, Western Electric Company, President of the National Association of Corporation Schools; Mr. James P. Munroe, of Boston, a member of the Federal Board for Vocational Education (which appointment will include the interests of the trade schools and schools of secondary grade), and Dr. Samuel P. Capen, of Washington, specialist in higher education.

"Under the direction of the Chief of Staff the functions of the committee shall be: To study the needs of the various branches of the service for skilled men and technicians; to determine how such needs shall be met, whether by selective draft, special training in educational institutions, or otherwise; to secure the cooperation of the educational institutions of the country and to represent the War Department in its relations with such institutions; to administer such plan of special training in schools and colleges as may be adopted."

"It is estimated that within the next 6 months 75,000 to 100,000 men will be given intensive training in schools and colleges. These men will be drawn from the armed forces of the Nation, the men now in training camps or about to be called thereto, and the registrants under the selective draft act. It is expected that most of the men selected for technical training will be taken from among the men who have registered under the selective draft law and who are awaiting training and the call to the colors."

When a requisition is received at the War Department this Committee on Education and Special Training, acting for the Chief of Staff, determines whether the men shall be obtained from the Army in the United States, or through the selective draft, or otherwise. If from the first source, it determines in terms of the records of the Central Bureau from what divisions the men may be obtained, as described above.

The War Service Exchange.—If the Committee on Education and Special Training determines that the men shall not be obtained either from the army or through the draft, it may turn to several sources. One of these is the War Service Exchange, another phase of the activity of the Committee on Classification of Personnel. This Exchange was organized by order of The Adjutant General on January 18, 1918. This is a directing agency for those desiring to enter the service whether in civilian, enlisted or commissioned capacity. The War Service Exchange is able to accomplish this because it is constantly informed of the personnel needs of the Staff Corps. A total of 11,196 written offers of service and 1,580 personal

interviews of a similar nature have been handled so far. Over 3,000 of these men have been placed in government service. The War Service Exchange also assists the Staff Corps in active campaigns to secure men of special abilities, through connections with Universities, Engineering Societies, Commercial Organizations, the Department of Labor, and other agencies of a similar character. On March 15th it took over the work of the Inter-Collegiate Intelligence Bureau. The War Service Exchange is in a sense a liaison agency between the War Department and the Department of Labor. It is charged with keeping informed as to such needs of the Staff Corps as the Department of Labor is prepared to supply through its Federal Employment Service and the Public Service Reserve. It is charged with reporting such needs to the Department of Labor.

Rating of Officers.—Another activity of the Committee on Classification of Personnel is the development of accurate methods for the rating of officers and candidates for commissions in the Officers Training Camps. This work is based on the rating scale devised by Dr. Walter Dill Scott for use in selecting salesmen under the auspices of the Bureau of Salesmanship Research at Carnegie Institute of Technology. The rating scale for officers was first used in eight of the Officers Training Schools, first series. Since then it has been adopted for all such schools and was used in connection with the third series in selecting candidates for the schools as well as for rating them while in attendance. Its use has been further extended so that all line officers in America are now rated by it, as well as all Coast Defense and Quartermaster officers. A somewhat different scale has been adopted and is now in use for all civilian employees in the Quartermaster Corps at Washington. At the present time other scales are being developed for use in the Signal Corps, Air Division, one for the pilots and observers and another for administrative officers.

Cooperation with the Provost Marshal General.—A plan for securing usable information concerning the nine million registrants was prepared and submitted to the Provost Marshal General and its provisions were partially embodied in the Questionnaire issued by the latter to the men within the draft age. The Committee also formulated plans for an occupational analysis and card index of all the registrants by which relative drafts could be made. In the main this plan is now being put into operation.

Army Paper Work.—A constructive study of army paper

work so far as it has to do with the personnel of the army was made. Suggestions for reducing this paper work are under consideration.

Intelligence Tests.—Assistance has been given to the Surgeon General's Department in devising and giving a series of general intelligence tests at four of the National Army Divisions. This work is now to be extended to the entire army. Record of the intelligence ratings is kept on the enlisted man's and officer's Qualification Card.

Selection of Aviators.—Dr. E. L. Thorndike has carried on an extensive investigation as to the relationship between success in flying and the items in the present application blank used by Examining Boards. The results are not at present available for publication. Further investigations are being conducted at present. It is believed that ere long a much more adequate method for the selection of aviators will be available whereby a larger per cent of men can be selected from the start who will make good in this very important phase of army work.

Work in the Navy.—Dr. Raymond Dodge has devoted his energies to methods of selecting and training men for certain specialized duties in the navy. Several such assignments have been successfully carried out; others are still under way.

The active members of the Committee on March 10th were:

Walter Dill Scott, Director, Director, Bureau of Salesmanship Research, Carnegie Institute of Technology, Pittsburgh.

E. L. Thorndike, Chairman. Professor of Educational Psychology, Teachers' College, Columbia University, New York.

W. V. Bingham, Exec. Sec., Head of Division of Applied Psychology, Carnegie Institute of Technology, Pittsburgh.

J. R. Angell, Dean of the Faculties, University of Chicago, Chicago.

R. C. Clothier, Director of Employment, A. M. Collins Mfg. Co., Philadelphia.

W. R. De Field, Superintendent of Systems, Montgomefy, Ward and Co., Chicago.

Raymond Dodge, Professor of Psychology, Wesleyan University, Middleton, Conn.

Edward K. Strong, Jr., Professor of Psychology. George Peabody College for Teachers, Nashville, Tenn.

J. B. Watson, Major, U. S. R. Signal Corps, Professor of Psychology, Johns Hopkins University, Baltimore.

R. M. Yerkes, Major, U. S. R., Surgeon General's Staff, Professor of Psychology, University of Minnesota, Minneapolis, Minn.

Inactive and former members are:

H. L. Gardner, Director of Employment, Dupont Powder Co., Wilmington, Del.

J. F. Shepard, Assoc. Professor of Psychology and Supervisor of Building Construction, University of Michigan, Ann Arbor, Mich.
L. S. Terman, Professor of Educational Psychology, Stanford University, Calif.

Military associates of the Committee are:

R. I. Rees, Col., General Staff, U. S.; Grenville Clark, Major, A. G. D. U. S. R.; E. N. Sanctuary, Major, A. G. D. N. A.; L. H. Whiting, Major, A. G. D. N. A.; B. J. Kempter, Capt., Artillery, N. G.; J. Perry Moore, Capt., A. G. D. N. A.; S. C. Garrison, 1st Lieut., A. G. D. N. A.

Civilian associates of the Committee are: 1. *In the Office at Washington.*

P. J. Reilly, Supervisor of Camp Work, Employment Manager, Dennison manufacturing Co., Framingham, Mass.
S. J. Gummere, Office Manager, Paymaster, P. B. and W. R. R. Co., Philadelphia.
A. C. Robinson III, Supervisor of Personnel Statistics, Architect, Sewickley, Pa.
R. B. Perry, Professor of Philosophy, Harvard University.
W. L. MacCoy, Acting in Mr. Robinson's place during his absence, Lawyer, MacCoy, Evans & Hutchinson & Lewis, Philadelphia.
Miss M. L. Free, Assistant Office Manager, Asst. in Psychology, Carnegie Institute of Technology, Pittsburgh.
E. S. Robinson, Statistician on Rating Scale, Asst. in Psychology, University of Cincinnati, Cincinnati.
F. Meine, Statistician on Rating Scale, Fellow in Psychology, Carnegie Institute of Technology, Pittsburgh.
Miss M. D. Hughes, Filing and Accounts, Asst. Registrar, Margaret-Morrison Carnegie School, Pittsburgh.

2. *Supervisors in Camps.*—The following employment managers have been used for varying lengths of time in installing and supervising the personnel work in the camps. Those starred have served at this writing four or more months.

C. F. Axelson, Northwestern Mutual Life, Chicago.
Philip Brasher, Chili Exploration Co., New York City.
*Wm. Clark, International Harvester Co., Chicago, Ill.
N. F. Dougherty, Pennsylvania Railroad, Philadelphia, Pa.
O. L. Davis, Jr., O. L. Davis Lumber Co., Trinidad, Colo.
J. W. Dietz, Western Electric Company., Chicago, Ill.
C. R. Dooley, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.
A. A. Goes, Goes Lithographing Co., Chicago, Ill.
R. B. King, Hyatt Roller Bearing Co., Newark, N. J.
*W. S. MacArthur, Armour and Co., Chicago, Ill.
S. B. Mathewson, Southern Bell Tel. and Tel. Co., Atlanta, Ga.
D. J. O'Connor, Swift & Co., Chicago, Ill.
*R. H. Puffer, Larkin Co., Buffalo, N. Y.
W. A. Sawyer, American Pulley Co., Philadelphia, Pa.
J. E. Sheridan, Crane Co., Chicago, Ill.

*A. J. Turner, Washington Water Power Co., Spokane, Wash.
*Kendall Weisiger, Southern Bell Telephone and Telegraph Co., Atlanta, Ga.
C. J. Whipple, Hibbard, Spencer, Bartlett Co., Chicago, Ill.

3. *Civilian Associates in the Division of War Service Exchange.*

Winslow Russell, Agency Manager, Phoenix Mutual Life Insurance Co., Hartford, Conn.
J. J. Coss, Assistant Professor of Philosophy, Columbia University, New York. In charge, Personnel Sub-Division of the General Administrative Division, Quartermaster Corps.
C. W. Jones, Mgr. Service Dept., Erwin & Wasey Co., Chicago.
H. F. Magee, Charge of Contract Division, Phoenix Mutual Life Insurance Co., Hartford, Conn.
C. L. Procter, Traveling Salesman, Moore Grocery Co., Tyler, Texas.
S. H. Roth, Student at University of Chicago, and President of Undergraduate Council, University of Chicago.

4. *Civilian Associates in the Division of Trade Tests.*

M. M. Jones, Supervisor of Personnel, Thomas A. Edison, Inc., Orange, N. J.
J. J. Swan, Consulting Mechanical Engineer, Philadelphia, Pa.
L. B. Hopkins, Manager's Assistant, General Electric Co., Pittsfield, Mass.
Beardsley Ruml, Instructor in Psychology, Carnegie Institute of Technology, Pittsburgh, Pa.
T. R. Stocksdale, Engineer and Assistant Manager, W. P. Perry Electric Co., N. Y.
J. C. Chapman, Professor of Educational Psychology, Western Reserve University, Cleveland.
T. L. Kelley, Assoc. Professor Psychology, Columbia University, New York.
J. A. Balcom, Mechanical Engineer, Bayonne, N. J.
W. P. Schatz, Secretary Manager of Middlesex County Farm Bureau, Waltham, Mass.
Max Watson, Civil Service Examiner, Sacramento, Calif.
T. M. De Blois, Production Engineer, Plainfield, N. J.
R. F. Evans, Employment Manager, J. H. & C. K. Eagle, New York.
A. D. Fell, Business Training School Salesman, New York.
J. N. Field, Railroad Secretary, N. Y.
A. C. Rader, Production Supervisor, Orange, N. J.
L. L. Thurstone, Assistant Professor of Psychology, Carnegie Institute of Technology, Pittsburgh, Pa.
Rudolph Pintner, Associate Professor of Psychology, Ohio University, Columbus, Ohio.
T. J. Kirby, Professor of Secondary Education, University of Pittsburgh, Pa.

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TRAINING COURSE OF THE AMERICAN STEEL & WIRE COMPANY

By Charles R. Sturdevant

No arguments are needed in these days to show why salesmen or other men holding responsible positions should, in some manner, be given special training and be encouraged to become the very best of which they are capable. This principle has become so thoroughly recognized and so firmly established that today hundreds of our leading business and industrial concerns either have well established courses, or are casting about to discover some effective way of training those employees holding responsible positions.

With concerns housed in one building, or in a single group of buildings, the problem is comparatively simple, for the men to be trained can be brought together once or twice a year or oftener and given a thorough training by having them confer with the several department heads, listen to lectures, and make inspection trips through the mills. But when the mills are widely scattered, and when widely differing products are made in them, the problem becomes a difficult one.

The American Steel & Wire Company employs from thirty to forty thousand men and women in its offices and mills. From the crude raw materials mined from the earth, this Company makes all the common grades of steel and it works this up into every conceivable kind and size of wire classified as common product, in its mills located in the Chicago, Cleveland, Pittsburgh and Worcester districts. From this wire it produces immense quantities of nails in great variety, from the needle pointed bill poster's tack to the ponderous boat spike, as well as barbed and woven wire fencing, etc. The Company also makes high grade steels of special analyses from which it produces telegraph wire, piano wire, rope wire, phonograph needle wire and motor springs and a practically endless list of highly specialized articles. In addition, wire of pure copper, both bare and insulated and the products of copper wire are produced in the Worcester District in great variety and heavy tonnage. As the business expanded and

the Company grew, there developed an insistent need of some thorough, systematic and uniform method of training its employees in all the matters pertaining to this varied and extensive business.

Prior to this period, for example, a salesman selling some one or two products in a territory remote from any mills would have little or no incentive to interest himself in the other products of the Company and would probably have a limited knowledge of the materials and processes involved in the manufacture of his own specialities. Also a mill man devoting all his time and energies to the production of some one or two products would have very little opportunity of learning the other phases of the business closely related to his own. The problem consisted of devising means for quickly and economically giving these men who had for years been confined to narrow lines of activity, a broad general knowledge of the whole steel and wire business.

That it must be an intensive course of study was soon manifest. Those in charge of organizing the course had many misgivings as to whether middle-aged, practical and non-technical men wholly unaccustomed to study could stand several weeks of intensified application to study or whether they would be willing to submit themselves to such a course. The work as later developed showed that these misgivings were not justified.

The course was instituted in 1912, and it has met with such success that we trust a description of the work will be of general interest to the readers of the JOURNAL OF APPLIED PSYCHOLOGY.

As originally organized the course was intended for veteran salesmen only, but shortly afterwards it was found advisable to slightly modify the course and make it suitable for semi-executives from other departments as well. The course is intended only for employees who have been in our employ for a considerable period—not for beginners. It is carried on under the immediate supervision of three competent instructors taken from the organization, and requires practically all of their time.

Two of the instructors had been in the employ of the Company for a long period and had acquired a very thorough practical knowledge of all phases of the wire business, one as superintendent of mills, the other as an expert in testing and inspecting of wire products. These two men conduct the classes through the mills. The third, who has had immediate charge of the work, had been a collegiate teacher in earlier

years and had spent the last few years in engineering and technical work.

The class spends one week in the Pittsburgh district, three in the Cleveland district and two and one half at Worcester, Mass. To complete the course requires six and one half weeks of intensive study and application on the part of the men. All traveling expenses are paid by the Company and a daily allowance is made for living expenses.

Each class has been organized by the secretary of the Training Course Committee. About a month before the date set for the beginning of a class, the secretary would write to the several department heads of the Company requesting them to appoint a definite number of men from their respective departments for this particular class. Each department head would in turn call upon his lieutenants for candidates, and in a week or so a class of about twelve men would be organized. About seven such classes have taken the course each year. The twelve men constituting a class are purposely chosen from different parts of the United States, and from various departments. Ordinarily there have been about two men from the Operating Department, one from the Accounting, one from the Order Department, and eight from the Sales Department. In general these men differ widely in age, experience and capabilities. The close association, for six and one-half weeks, of such a diversified group of men, is in itself a liberal education.

When the men are first notified of their appointment to a given class most of them anticipate the work with dread and some have tried to have their appointment postponed, having heard exaggerated reports of the training being unpleasant and the work difficult. On the other hand, a few have eagerly sought the opportunity of taking the course and have welcomed the summons when it came. But before the end of the first week of the course every man with scarcely an exception has stated that he was glad he came and that he would not have missed it for anything.

In most cases the moment a man is selected to take this course of training he assumes a new line of thought. The very fact that he is chosen to be specially trained gets him out of the rut of every day happenings in his sphere of activity. It is either a mark of appreciation for past efforts or the belief that he can become a more valuable man. In either case it is now for him to show whether or not he can measure up to the opportunity. With this in mind he begins the training with a different mental attitude from that which he held toward

his regular work day after day, and for these reasons the effect of sending a man to different cities to be trained may be well worth the cost. In either case the man's selection as being capable of absorbing an intensive course of instruction is a mark of distinction which has its effect even on those who are apparently callous to such influences.

The first desire of the average man is to make good and having been selected for a special course which involves the use of his brains as well as those of his observing powers he goes to the new task in a receptive mood. He may be a little skeptical as to the ability of anyone teaching him more than he already knows of his work, but he believes it is up to him to learn something new or to explain why he could not do so. Thus his mind is more alert than before and being one of a class of twelve, all having the same opportunities and studying the same lessons further places the man on his best efforts and best behavior.

The men selected for a given class are given about three weeks' previous notice, and are, at the same time, assigned suitable preparatory reading matter. At the appointed time they assemble at Pittsburgh, Pa. where they will meet an instructor who organizes them into a class and requires them to fill out a registration blank.

Nearly all of the first week is taken up in making inspection trips through various steel and wire mills in or near Pittsburgh, in order to afford the men an opportunity of obtaining a general idea of how all our products are made and of the work to be taken up in the course, and also to inspire them with a desire to go more thoroughly into the details.

During the second week the class studies steel making. From step to step they learn how the ore is converted into pig iron, how this is transformed into the several grades of steel, and finally how the steel ingot is made into a wire rod. During the following week they are taught how the various grades and kinds of wire are made from rods. They become familiarized with our so-called common products, and with the process of manufacture. During the balance of the course they are shown and taught how wire is given special treatments in order to secure certain desired properties and to avoid certain other harmful properties; how the wire is tested, and how it is fabricated into the various commodities, common and special, made by the Company—such as woven wire fencing, wire nails, wire rope, electrical wires and cables and so on.

The real work of the course, it will be observed, begins

with the second week, after the men have become fairly well acquainted with each other, and with the work to be covered. Each day's work from then on (except on Saturdays) is divided into four periods: a forenoon mill inspection trip, a noon-day lecture and discussion, an afternoon quiz and evening recreation and study.

Each morning the class, under the guidance of an instructor and one or two mill foremen, is taken slowly through some one mill where the students witness the details of the process involved in making some one product or some group of closely related products, about which they studied the evening before; the making of rope wire, for example.

In this manner the men are given every opportunity of making a detailed study of all essential materials, processes and mill equipments. This systematic method of making mill inspection trips is very much more effective than the old way of sending the men alone into the mill to wander about aimlessly.

Just before, or after, the midday lunch, the mill superintendent, or department expert, will carefully review the morning's work, and afford the men an opportunity of asking questions and entering a general discussion. During the latter part of each afternoon, another instructor subjects the members of the class to a searching quiz, which helps greatly to organize the knowledge of the day's work, and to fix it in their minds. Each member of the class is encouraged to answer fundamental or leading questions, and if he cannot answer, another member is given an opportunity on the same question. During the session, the instructor clearly settles all important questions of doubt and forcibly brings out the salient points of the lesson. The fundamental scientific principles are described whenever possible. This quiz enables the instructor to determine very quickly the points which need to be especially emphasized, and it soon indicates to him the particular men who need personal help. It further gives each man an opportunity of measuring himself with others who have had equal privileges with him of study and mill inspection, and it is a strong agency to stimulate him to his best efforts.

At the close of each quiz, a small, specially prepared printed booklet, is given to each man, covering the following day's work, and the men are requested to study this thoroughly during the evening, even though they may not clearly understand it all, as an aid to the following day's work. It will be seen that the course is laid out on the budget system—a full day being devoted to some one subject. The various subjects, each of

which is treated in a separate booklet or lesson, are, of course taken up in logical order from day to day, proceeding from the simple to the more complex, the whole making one complete story.

On several occasions, the class is given regular set lectures by department heads. These cover the work being done by the Accounting, Order, Transportation and Welfare Departments, and matters pertaining to the organization as such. These are not only enjoyable diversions, but they serve to coordinate the activities of the various departments, and to bring the whole personnel of the Company into closer touch and sympathy.

STUDENT RECORD

SHORT TRAINING COURSE

Name in full, John Doe
Home Address, Grand Rapids, Mich.
Business Address, Chicago, Ill.
Present Occupation, Fence Dept.
Class No. . Date Started, July 30, 191 . Date Finished, Sept. 13, 191 .
Age, Years, 36. Nationality, American
Employed by Company, 9 years. Married or Single, Married.
Departments employed in during service, Sales Dept.
Education — Common School, 10 years.
High School, 2 years.
Technical School, Name,.....years
Technical Course taken.....Degree (if any).....
Practical Experience in Mills, Shops or Laboratories.....
Remarks: A large, fine appearing fellow, pleasing appearance and personality, clear thinker, independent and above board. A fine character and natural leader of men. Was greatly interested in and much benefited by the course.

EXAMINATION GRADES

1st week	2d week	3d week	4th week	5th week	6th week	7th week	Average
V. G.	G	E	—	V. G.	V. G.	—	V. G.

OBSERVED CHARACTERISTICS

Enthusiasm	E	Personality	E
Energy	E	Approach	E
Ambition	E	General Knowledge	V. G.
Thoroughness	V. G.	General Ability	E

(E, means Excellent. V. G., Very Good. G, Good. F, Fair. P. Poor)

Five written examinations are given, usually on Saturday mornings and at the close of the course, one whole day is devoted to a general oral review of the completed course. The weekly examinations cover the work of the week. No

catch questions are asked, only ten or twelve fundamental questions. These examinations are conducted on the honor system. They have given our men more concern than all else and have constituted one of the strongest incentives to diligent study. The papers are carefully reviewed and graded, and they help to make up the final report of each man, similar to the one shown. Copies of this report are sent to those officials of our Company who are directly interested.

In all our work we have attempted to do three things thoroughly. First, to train the men to *think straight* in the conception and application of essential fundamentals; second, to impart some information and specific technique to each man in his own line, and finally to give to all a more intelligent idea of the Company business as a whole.

While it is an intensive course of study, the work has been so laid out and is so handled as to require a minimum amount of time and effort on the part of the student. And while a great majority of the men are wholly unused to study or to close application at the time they enter the course, they do, in spite of these seeming handicaps, acquire a surprising amount of useful knowledge, even in so short a period as six and one-half weeks.

The limiting of the course to six and one-half weeks instead of being a disadvantage has proved to be a benefit, and here the element of psychology comes in. With a long course there would be no particular incentive to finish the lesson today. There is always a tomorrow, and it is a long time to the end of the course.

Limiting the course to six ond one-half weeks changes this attitude completely. Here is a certain definite number of lessons to be learned in a much shorter period, and evidently there is no time to be lost or wasted. The necessity for crowding in a full course in a given time, and that a short one, puts the student on his mettle and shows him the need of concentrating his mind on the course. All else must wait till this is done.

As to the resulting benefits both to the men and to the Company, they are many. Aside from the direct result of a greatly increased useful knowledge of the technique of the business, they are given a broadened view point and a quickened interest in their work. The free exchange of views during the course acquaints many for the first time with the difficulties which men in other departments have to overcome. This new knowledge is conducive to better team work and makes the men less critical. The course stimulates self con-

fidence, loyalty and good fellowship. It enables our salesman to take an affirmative positive attitude towards his prospective customers not possible for one who does not actually know what he is talking about. He is in a position to advise his customers as to kinds or grades of materials which should be used for certain purposes or processes. In the minds of many it has created a new and wholesome respect for real knowledge; it has clearly brought out the difference between facts and opinions. In conversation and correspondence the men fairly bubble over with enthusiasm and with confidence in their ability to discuss steel and wire matters. The one great regret of the older men who have taken the course is that they were not given this opportunity earlier in life.

VOCATIONAL TESTS FOR RETAIL SALESWOMEN

By Elsie Oschrin, A.B., Barnard College, Columbia University

The purpose of this investigation was to obtain, if possible, a vocational correlation for sales ability of the lower grade, particularly of that type found in a retail department store.

The subjects of the experiment were a group of eighteen saleswomen in one of the largest department stores of New York City, who formed a class in salesmanship. These women had all been selling for an appreciable length of time and had been chosen for instruction by their respective buyers because of the promise they showed in their work. They were employed in various departments of the store, linings, veilings, notions, art embroidery, infants' wear, dresses, waists, underwear, handkerchiefs, etc., and received salaries that (including commission) varied from $16.00 to $8.00 per week.

The group was tested with a list of thirteen tests, eleven of which were standard tests. Two were devised by the experimenter, and were based upon a similar test used by Münsterberg[1] upon salesmen.

The standard tests were

1. Trabue Completion-scale A
2. Number Checking
3. Opposites
4. Mixed Relations
5. Verb Object
6. Substitution
7. Color Naming
8. Hard Directions
9. Knox Cube
10. Cancellation
11. Association-Kent-Rosanoff

The new tests were rearrangements tests. Two lists—one of animals, the other of cities—were presented, with however the letters of the word in each case in random order, thus, skunk-snkuk, Bombay-yabmbo. The lists were arranged in an order of increasing difficulty and the group instructed to reconstruct the words, passing regularly down the list, but skipping any word that presented too great difficulty. They were limited to ninety seconds for each list and were informed as to whether it was animals or cities they were to look for.

[1]Burtt, H. E. *Journal of Applied Psychology*, Sept., 1917.

REARRANGEMENT TESTS

Animals		Cities	
snkuk	skunk	yabmbo	Bombay
niol	lion	sarip	Paris
rede	deer	lndono	London
tgrei	tiger	tosbon	Boston
barze	zebra	ksnaas	Kansas
selwae	weasel	gabdda	Bagdad
bnsio	bison	beuqca	Quebec
leum	mule	tyor	Troy
seomu	mouse	latcatuc	Calcutta
shroe	horse	caghioc	Chicago
goroanka	kangaroo	tnotrne	Trenton
delopra	leopard	karnwe	Newark
haplente	elephant	bylana	Albany
kmyeon	monkey	lbnire	Berlin
duonh	hound	revdne	Denver
ycteoo	coyote	nanpaolsi	Annapolis
lqriurse	squirrel	tnosuho	Houston
kunmpchi	chipmunk	remitlabo	Baltimore
rotligala	alligator	tormlean	Montreal
laglroi	gorilla	sbucouml	Columbus
tinram	martin	satleet	Seattle
lettru	turtle	fatrdohr	Hartford
clreoicdo	crocodile	dartplnod	Portland
peatnole	antelope	rimdonhc	Richmond

The remainder of the tests, except color-naming and Knox Cube, were given as group tests and in orthodox fashion, the time limit being that of the first subject finished for all but the Trabue Completion, for which four minutes were allowed. In the association test everyone was permitted to complete the hundred associations. Color naming and Knox Cube were given to each member of the group individually. The group was tested over a period of six weeks, at ten o'clock in the morning.

Seven objective ratings of each member of the group were obtained. These were

1. *Buyer's estimate.* The buyer under whom each girl worked and who was personally well acquainted with her work was visited and asked to construct a scale of sales ability and to locate the girl upon it. The scale was made by asking the buyer to place at 1 the best salesgirl he had ever known, at 5 the poorest, at 3 one midway between the extremes, and at 2 and 4 women between 1 and 3 and 3 and 5 respectively. Then he was asked to compare the girl in question with the people on the scale and to locate her by this comparison. The group was then arranged in order of merit according to the positions of the individuals upon these scales.

The accuracy of this final order is somewhat doubtful, inasmuch as the varying tempers and temperaments of some fourteen buyers, their antagonism to, interest in, or indifference to the experiment and the experimenter, and their varying standards of sales-ability make for many sources of error, especially when an attempt is made to render their divers judgments into a homogeneous whole.

2. *Salary.* The group was ranked according to salary. This ranking is not as valuable as at first glance it may seem to be, inasmuch as length of service, age and department are as potent wage determinants as actual sales ability.

3. *Teacher's ranking for salesmanship.* This ranking was made by the teacher of the salesmanship class at the end of the six weeks course, during which time the teacher had seen the group every day. It was the result of her knowledge, through actual observation, of their selling on the floor, her observation of their class performance, of an examination given by her at the close of the course, and of a detailed report submitted to her by the buyer and section manager of each woman.

4. *Ranking for General Intelligence* by the teacher.

5. *Average ranking.* The average of the ranks in salary, and buyer's and teacher's estimate of sales ability was calculated and the group arranged in an order of merit according to this average position.

6. *General rating.* At the time of testing each woman was interviewed and her age, education, nationality, i.e., whether native or foreign born, selling experience, period of employment in her present position, weekly salary, average weekly commissions, and the department in which she worked, were ascertained. This information was placed upon a card, one for each woman, together with her rating for salesmanship and intelligence by the teacher and for salesmanship alone by the buyer. These cards were submitted to thirty-seven students of a graduate course in Advertising and Selling at Columbia University with instructions to arrange the cards in an order of merit, judging each girl for her sales ability on the basis of all the information on each card.

7. The seventh, called *Selected Group Judgment,* is a refinement of the sixth. Of the group of thirty-seven students twenty-two had had experience in either hiring or handling sales people or had actually been salesmen themselves, fifteen had had absolutely no experience whatsoever. These fifteen

were eliminated and an average ranking for each saleswoman obtained from the judgments of the smaller selected group.

The value of these seven measurements varies. By far the most valid, it would seem, are the teacher's judgments of the group, based as it is on an all round and fairly intimate knowledge of all the subjects. Its value is further confirmed by the fact that it shows a correlation of only +.28 with the judgments for general intelligence, which indicates that it was something other than general intelligence itself upon which ability to sell was judged. That this other something was a quality recognized by the teacher and buyer in common and may therefore be inferred to be actual sales ability is evidenced by the fact that the coefficient of correlation between the teacher's judgment of sales ability and the buyers' was +.43.

The teacher's judgment of intelligence is valid, of course, and interesting, but is not so valuable for the purposes of this experiment. The reasons for the unreliability of salary and buyers' estimates have already been discussed and need not be repeated. The average rank, composite that it is, of salary, buyers' estimates and teacher's judgment of sales ability strikes a point somewhere between the invalidity of the first two measurements and the accuracy of the last.

The last two measurements and particularly that of the selected group present a more truly composite picture than the average ranking. They are based on a complete sales history of each individual, are made by fairly competent judges, and may be considered of equal value with the teacher's judgment of salesmanship, with which indeed the sixth correlates +.86 and the seventh +.89. The two judgments—teacher's and group—supplement and correct each other, for what the one gains by personal knowledge is equalled in the other by the added accuracy and freedom from errors of individual judgments which group averages give.

The scores made in the thirteen tests were ranked for each test and correlated with the seven objective ratings by the Spearman formula.[2] Table I below presents the coefficients of correlation between performance in these tests and actual sales ability as indicated by the seven objective methods of ascertaining it.

The correlations of the tests with the buyers' estimates and with salary indicate for the most part a chance relationship and are consequently not significant. Some such results were to have been expected from the unreliability of both methods

[2] Used throughout in the experiment.

TABLE I.[3]

Tests	Teacher Buyer	Salesmanship	Intelligence	Salary	Average	General Rating	Selected group
Completion	—.04	.40	.81	.01	.12	.43	.51
No. Checking	.29	.43	.15	—.32	.13	.37	.41
Opposites	.26	.65	.52	.30	.55	.59	.62
Mixed Relations	—.07	.50	.69	.05	.32	.55	.66
Rearrang. Animals	.05	.45	.58	.23	.31	.53	.52
Rearrang. Cities	—.32	.38	.35	.07	.17	.30	.42
Verb Object	.20	.21	.55	.03	.29	.51	.47
Substitution	—.03	.15	.20	—.36	—.13	.13	.35
Color naming	.07	.31	.30	.11	.21	.39	.31
Directions	—.004	.41	.64	—.12	.14	—.25	.09
Knox Cube	—.13	.12	.61	—.06	.06	.27	.43
Cancellations	.49	.41	.01	—.33	.16	.28	.42
Association—Individ	.53	.01	—.32	.57	.48	—.30	—.33

[3] The probable errors for these Coefficients are as follows:

Probable errors for Formula $r = I - \frac{6\Sigma D^2}{n(n^2-1)}$ when n is 18.

r	P. E.	r	P. E.
.00	.166	.50	.125
.10	.165	.60	.107
.20	.159	.70	.085
.30	.151	.80	.059
.40	.139	.90	.031

TABLE 2

TEAM CORRELATIONS

Sales Ability			Intelligence
1. Teacher	2. Selected Group	3. Av. of Teacher and Selected Group	
Opposites ..... .65	Opposites ..... .62	Opposites	Knox Cube ..... .61
Relations ..... .50	Relations ..... .66	Relations	Relations ..... .69
Rearrang. Animals ..... .45	Rearrang. Animals ..... .52	Rearrang. Animals	Rearranged Animals ..... .58
No. Checking ..... .43	Completion ..... .51		Completion ..... .81
Cancellation ..... .41	Verb-Obj. ..... .47		Directions ..... .64
Directions ..... .41			
.76	.69	.62	.75

of estimation. Individuality of association alone shows a relatively high positive correlation with these two, +.53 with the buyers' judgment and +.57 with salary.

The other measurements, in which we seem justified in placing a greater degree of confidence, show coefficients whose general character is much higher and positive. The average ranking of course produces a coefficient that is not so low as salary and buyer coefficients and not so high as that obtained from the teacher's estimate. It is an interesting and pertinent fact worthy of note here, that, whereas the group judgment is fairly high throughout, in almost every case correlation with the new order obtained from the selected group raised the coefficients to a marked degree.

If from the tests we select those which gave the six highest correlations for the teacher's judgment of sales ability, those which gave the five highest for intelligence and also those which gave the five highest for selected group judgment, average the rankings of each of these groups and correlate these averages with their respective measurements we obtain a group which correlates +.76 with sales ability as judged by the teacher and a slightly different group which correlates +.69 with sales ability as judged by the selected group.

Three tests of these two groups are identical for both groups, —mixed relations, opposites, and rearrangement of animals. When the average ranks of these three tests were ranked and correlated with the ranks obtained from an average of the teacher's judgment for sales ability and that of the selected group a coefficient of .62 was obtained. The team for intelligence gives a coefficient of .75. See Table 2.

TABLE 3.

JUDGMENT CORRELATIONS.

		Teacher			General	Sel.
	Salary	Sales.	Intell.	Average	Rating	Group
Buyer.....	.24	.43	—.01	.76	.67	.47
Salary.....	...	.20	.02	.63	.28	.19
Teacher S....	...	...	.28	.73	.86	.89
Teacher I....	...	...	...	.34	.68	.77
Average.....	...	...	...	...	.88	.74
General Rating	...	...	...	...	...	.97

The evidence throughout the experiment seems to indicate that the type of sales ability called for in a retail department store is a fairly measureable function in terms of mental tests, with which it shows a definite tendency to correlate positively. Vocational selection may very well be made upon the evi-

dence of performance in such tests, and our results point to three in particular,—mixed relations, opposites and rearrangement of animals—which may be used with an accuracy of +.62 in such selection. Of course the group used in this experiment is too small for the absolute values obtained in correlation to have any binding significance, but the direction, at least, in which these values point, is unmistakable and indicates that the field of retail salesmanship is one open to much profitable investigation by the vocational psychologist.

OBSCURITIES IN VOTING UPON MEASURES DUE TO DOUBLE-NEGATIVE[1]

By Eleanor Rowland Wembridge and Edgar R. Means

In the Oregon election of November 7, 1916, a curious vote was registered by the people. Although the negroes have had the vote in the U. S. A. since the Federal Amendment giving them that privilege in 1865, the state constitution of Oregon, denying them that right, has never been amended to conform with the Federal law. There are not many negroes in Oregon, and there is no more race feeling than in any northern state. The negro votes freely at elections without intimidation of any kind. Since November 1912, the negro woman has also enjoyed that privilege. But in the 1916 election an attempt to repeal the restriction against the negro vote, which existed only on paper, and give him the formal state right which he already had in reality, failed. Despite the negro vote on the measure, despite the fact that its passage was considered a foregone conclusion, and despite the surprise on the part of most of the voters at finding that this inconsistency existed in the Oregon constitution, a negative vote was registered by a small majority, and the negro remains deprived of voting rights by the state constitution, although he still votes unmolested as before.

The outcome of the vote on this measure occasioned considerable comment, because of the uselessness of the negative vote, and the difficulty in interpreting the state of mind which lay behind such a failure to see the issue clearly. The generally accepted explanation was, however, that the voter had been confused as to whether he was voting on his convictions that the negro should or should not be deprived of the vote, or whether he was voting on a measure repealing the restriction against him. It could readily be possible that a voter would vote "No" meaning, "I do not believe in restrictions against negroes," whereas his "No" would really register against the removal of the restriction. The general surprise of the voting public upon the outcome indicated clearly that it

[1]From the Psychological Laboratory of Reed College, Portland, Oregon.

represented no body of opinion, and that it was probably largely accidental.

Another measure on the same ballot was the "Anti-Compulsory Vaccination" law. This was a hotly contested measure, in which the doctors and educated classes in general were ranged on one side against enthusiastic vaccination fighters on the other, backed by certain faith healing sects. The law was passed repealing the former compulsory vaccination law, but many of the voters protested afterwards that they had voted exactly opposite to their convictions. Their "Yes" meant to them, "Yes, I believe in compulsory vaccination" whereas it had registered, on the contrary, "Yes" to the repeal of the compulsion.

Other examples might be cited in recent elections, such as the recent vote against Woman Suffrage in Ohio. An act of legislature, known as the Reynolds Act, had given the women the right to vote for presidential electors. A referendum brought the matter again before the voters. So indignant were many of the suffragists against the calling of a referendum, and so much was said against it, that there was confusion on the part of the voter, as to whether he was voting "No" against having a referendum, or "Yes" for the approval of the Reynolds Act. The success of the referendum, and the failure of the act were laid by many to this confusion of the issue.

Such being the state of affairs in various elections, it was decided to test the matter in the psychology laboratory.

As a preliminary, 16 propositions were taken, and expressed in 6 different ways; simple affirmative, simple negative (with a word like *prohibit*), simple negative (with the word *not*), double negative (with words *not* prohibit), double negative (with *prohibit* prohibit), and double negative (with not not). These various forms were supposed to cover the ways that negatives, in either an open or disguised form, are made use of on ballots. Thus a measure that "minors shall not be allowed to smoke," that "minors shall be prohibited from smoking" are both single negatives; that "minors shall not be prohibited from smoking," that "it is prohibited to prohibit minors from smoking" and that "minors shall not be forced not to smoke" are all substantially double negatives. Ninety-six such propositions were tried upon 4 members of an experimental class. The measures were read, and the length of the interval between the time the experimenter finished reading and the moment the subject registered his vote was recorded. The subjects were given the list twice, and an

average of the time intervals was taken. The latter were as follows:

1. Simple affirmative, 1.7 sec.
2. Single negative (prohibit, etc.), 3.0 sec.
3. Single negative (not), 3.7 sec.
4. Double negative (not prohibit), 6.4 sec.
5. Double negative (prohibit prohibit), 8.23 sec.
6. Double negative (not not), 8.25 sec.

This result was merely an indication of the increase in difficulty in passing a judgment. We wished however to get votes based upon convictions, in which the ballots would be cast as nearly as possible as they are in reality, and in which we could measure the variation in the vote due to the introduction of negatives in the statement.

We therefore prepared two printed ballots upon which were ten measures of general interest to the voters of Portland. On the first ballot the ten measures were worded affirmatively and set up in the form of an ordinary ballot. On the second ballot the same ten measures were so worded as to contain negatives in varying numbers. Every effort was made to approximate as nearly as possible actual voting conditions. The subjects to be tested were given the first ballot, and required to vote according to their convictions on each of the ten measures. At a later time they were given the second ballot, and asked to vote according to their convictions again, emphasizing the fact that they were to express the same attitude toward the measure in both cases. If they had changed their minds on the way they wished to vote, they were asked to indicate this in the margin, but the marked ballot was to indicate an identical point of view as regards the measure in question. Nothing was said about the presence of negatives or the purpose of the experiment, but the subjects were merely asked to sign their names to the two ballots. The method permitted group experimentation, and the ballots were submitted to seven classes. This included two college classes, three business college classes, one class of Y. M. C. A. students, and one class of high school students. Because of the necessity of having exactly the same groups give their time to the experiment on two different days, it was impossible to add to these the groups of business men and of day laborers which we had hoped to include. The groups included men and women (since Oregon women are voters) and the voters ranged from 18 to 27 years of age.

SIMPLE AFFIRMATIVE STATEMENT

Name ..... Date .....

INSTRUCTIONS: Please write your name and date on the appropriate blanks above. Vote your convictions on the following measures, regardless of whether you think they are now laws or not. Please vote without consultation with others.

Mark X *after* the word Yes or No, according to your convictions, at the left hand side of the page and under each measure.

1. COMPULSORY MILITARY TRAINING. PURPOSE.—To provide for three years of compulsory military training for every able-bodied citizen (male) of the United States, between the ages of 21 and 27 years. Vote Yes or No.

Yes.....
No.....

2. DIRECT ELECTION OF PRESIDENT. PURPOSE.—An amendment to the Constitution of the U. S. providing for the election of President and Vice-President by direct vote of the people. Vote Yes or No.

Yes.....
No.....

3. EQUAL SUFFRAGE AMENDMENT. PURPOSE.—An amendment to the Constitution of the United States providing for the extension of the right of political suffrage to women on the same terms as now enjoyed by men. Vote Yes or No.

Yes.....
No.....

4. AMENDMENT TO CONTROL MANUFACTURE AND SALE OF ALCOHOLIC LIQUORS. PURPOSE.—An amendment to the Constitution of the State of Oregon providing for the regulated manufacture and sale of four per cent alcoholic liquors. Vote Yes or No.

Yes.....
No.....

5. UNIVERSAL EIGHT HOUR WORKING DAY. PURPOSE.—To provide for an eight hour working day for both men and women in all industries in Oregon. Vote Yes or No.

Yes.....
No.....

6. FOUR CENT FARE. PURPOSE.—A municipal ordinance initiated by the people of the city of Portland, providing that all common carriers doing business in the said city of Portland shall be required to provide four cent service for transportation from one section of the city to another. Vote Yes or No.

Yes.....
No.....

7. CAPITAL PUNISHMENT. PURPOSE.—To provide for the re-establishment of the death penalty in the State of Oregon as a punishment for the crime of murder in the first degree. Vote Yes or No.

Yes.....
No.....

8. SAILING PRIVILEGES. PURPOSE.—An act permitting American citizens to sail only on ships flying the American flag. Vote Yes or No.

Yes.....
No.....

9. SHIP ARMAMENT. PURPOSE.—To authorize the arming of American ships engaged in foreign trade. Vote Yes or No.

Yes.....
No.....

10. MUNICIPAL ELECTRIC PLANT. PURPOSE.—A bill referred to the people of Portland by the Commissioners of said city, providing for the purchase or construction of a municipal light and power plant and refusing all further franchises to private companies. Vote Yes or No.

Yes.....
No.....

COMPLEX NEGATIVE STATEMENT

Name ..... Date .....

INSTRUCTIONS.—Fill out blanks above.

Vote your convictions as voted before. If you desire to change your vote as cast before, please indicate such change by crossing out the number at the beginning of the measure so changed. Thus,

1. ANTI-COMPULSORY MILITARY TRAINING. PURPOSE.—To provide that an able-bodied male citizen of the United States over the age of 27 years, shall not be prohibited from enjoying the rights and privileges of citizenship who shall not have had three years of military training. Vote Yes or No.

Yes.....
No.....

2. DIRECT ELECTION OF PRESIDENT. PURPOSE.—An amendment to the Constitution of the United States abolishing the provision of the Constitution prohibiting the President and Vice-President from being elected by direct vote of the people. Vote Yes or No.

Yes.....
No.....

3. EQUAL SUFFRAGE AMENDMENT. PURPOSE.—An amendment to the Constitution of the United States providing that all the rights of political suffrage now enjoyed by men, shall not be prohibited to women. Vote Yes or No.

Yes.....
No.....

4. AMENDMENT FOR CONTROLLED MANUFACTURE AND SALE OF ALCOHOLIC LIQUORS. PURPOSE.—To amend that section of the Constitution of the State of Oregon, prohibiting the manufacture and sale of alcoholic liquors, by prohibiting the State of Oregon from prohibiting the manufacture and sale of four per cent malt liquors. Vote Yes or No.

Yes.....
No.....

5. UNIVERSAL EIGHT HOUR DAY. PURPOSE.—To abolish the law abolishing the law prohibiting an employer from employing labor in the State of Oregon for more than eight hours per day. Vote Yes or No.

Yes.....
No.....

6. FOUR CENT FARE. PURPOSE.—A municipal ordinance initiated by the people of the city of Portland, to abolish the ordinance of the city of Portland prohibiting the Commissioners of the city from requiring all common carriers doing business in the city to charge a four cent fare. Vote Yes or No.

Yes.....
No.....

7. CAPITAL PUNISHMENT. PURPOSE.—An act to abolish that section of the Constitution of the State of Oregon abolishing the death penalty as a punishment for murder in the first degree. Vote Yes or No.

Yes.....
No.....

8. SAILING PRIVILEGES. PURPOSE.—An act to prohibit Congress from prohibiting the President from requiring American citizens sailing for foreign countries to take passage on ships flying the American flag. Vote Yes or No.

Yes.....
No.....

9. SHIP ARMAMENT. PURPOSE.—An act repealing the law abolishing that enactment of Congress which prohibits the arming of ships engaged in foreign trade. Vote Yes or No.

Yes.....
No.....

10. MUNICIPAL ELECTRIC PLANT. PURPOSE.—A Bill referred to the people of the city of Portland by the Commissioners of said city, providing for the purchase or construction of a municipal light and power plant, and repealing the law prohibiting the Commissioners from refusing franchises to private companies. Vote Yes or No.

Yes.....
No.....

The table shows the number in each group experimented on; the percentage of confusion (by which we mean that the vote on the second ballot contradicts the vote on the first) on each of the ten phrasings for each group and the average percentage for each group as well as for each measure from all groups.

The table indicates that on no measure was the percentage of confusion in the second vote less than 12, and the lowest average obtained from any group was 28. Too much importance should not be attached to the variation in confusion in

TABLE

	Percentage of confusion by groups on each measure										Average percentage in each group
	1	2	3	4	5	6	7	8	9	10	
College students (64 subjects)....	30	17	12	18	51	34	17	33	42	29	28
High School students (22 subjects).....	31	36	13	59	45	45	13	50	31	31	35
Preparatory students (21 subjects) Y. M. C. A.	23	28	47	42	57	57	38	47	47	28	41
Business College students (107 subjects).....	46	54	36	45	63	57	42	54	34	45	47
Average percentage all groups.....	35	37	28	36	56	48	30	47	37	36	

the different groups of subjects, because of the smallness of the groups, and neither can we attach too much to the ranking of the different measures, since the range of percentages is so large that another set of samples would doubtless show wide fluctuation. The main value of the investigation, in our judgment, is the evidence that varied groups of voters are confused by the negative statements of a measure. Our conclusion is of course based on the assumption that all confusion was caused by the presence of negatives on the second ballot, and that the voters remembered their vote on the first ballot. Since the measures on the first ballot were stated as simply as possible, and the experimenter made every possible effort both by answering questions and making suggestions, to make the meaning of all the measures clear, we feel that this assumption is justified.

The obvious recommendation, after such an experiment is, that the clauses on a ballot, stating the purpose of a measure, should be stated affirmatively. To the argument that a negative statement confuses both sides equally, and therefore its influence is negligible, we would answer, that this reduces the vote to a chance rather than an intelligent vote, and furthermore, it gives an advantage to the NO vote, because of the well recognized tendency to vote No when in any doubt about the measure.

In closing, I will illustrate this recommendation by an example. In 1914 a vote was cast in Oregon on the Eight Hour Law for Women. Since the object was to *prohibit* the employment of women for more than eight hours, it would have

been easy to so word the ballot. This might have aroused in the voter an antagonism against a more than eight hour day, and the protest might have expressed itself in a No vote, which would however have registered against the voter's convictions, since to prohibit the employment of women more than eight hours, demanded a Yes vote. Many votes on the prohibition measure have been so confused.

The purpose as stated however was "To amend sections—and—of Lord's Oregon Laws, so as to limit the hours of labor for female workers, etc." In this way, the affirmative idea was emphasized, instead of the negative idea of prohibiting something, and the conviction YES, for the measure meant an affirmative vote, and vice-versa. By this means, we believe, the actual convictions of the voting population were registered at the polls.

A DRAWING COMPLETION TEST

By Rudolf Pintner and Herbert A. Toops, Ohio State University.

The completion test has long been a favorite test of intelligence, and it has proved itself of great value. The underlying idea of any completion test is that the subject shall supply some part which has been omitted and which is essential to the whole. Ebbinghaus seems to have been the first to have made use of the completion test idea as applied to language and since his time the language completion test has developed considerably and has proved to be one of our most valuable tests. The most notable extension of the language completion test is the series of completion test language scales devised by Trabue.[1] Binet seems to have been the first to have used the completion test idea as applied to pictures, using it in the test of "Missing Parts" in the Binet-Simon Scale. Evidently this test proved a useful one, because it has been retained in all the revisions and modifications of the Binet Scale. The picture completion test converted into a performance test is found in Healy's Picture Completion Test.[2] Here the response of the subject is limited by the number of blocks provided with the test, whereas in language completion tests the response of the subject is limited only by the extent of his vocabulary.

The Test

We have attempted to use the picture completion test idea for group testing. The response of the subject is in this case drawing the missing part of the picture, and it is for this reason that we have called it a Drawing Completion Test.

No language is required in performing the test. Furthermore, language is unnecessary in giving the test, although it will of course be used in giving the test to hearing English-speaking children. Because the language factor is eliminated in this test, it should prove very useful for foreign or deaf subjects.

[1]Trabue, M. R. Completion Test Language Scales. *Teachers College Contributions to Education*, No. 77, 1916, pp. 118.

[2]Healy, W. and Fernald, G. M. Tests for Practical Mental Classification. *Psychological Monographs*, No. 54, 1911, and also, Pintner, R. and Anderson, M. M.—The Picture Completion Test. *Educ. Psych. Monographs*, No. 20, Warwick and York, 1917.

Figure 1 shows the test as originally planned. It consists of 25 pictures each of which lacks an essential part. We attempted as far as possible to have the pictures so constructed that an essential part should be missing, that is, a part without which the picture would not be complete. The missing part should not be something that might very well be in the picture, but does not form an essential part of it. For example, Picture No. 17, is an example of what we consider a poor picture inasmuch as the picture is in itself complete, although there might very well be a knife added. The addition of the knife, however, is not essential to the unity of the whole. The picture is a unit as it stands at present. Picture No. 17 is the poorest of our group; all the others conform to the principle laid down above.

Presentation of the Test

The examiner, after distributing the test sheets and warning the children not to open the sheets until he gave the signal, drew on the blackboard the face of a man similar to Picture No. 1, but putting in two eyes and omitting the mouth. He then called a child to the blackboard motioning or telling the child, according as he was a deaf or hearing child, to finish the picture. What is required is obvious at once to all children, with the exception of those who are very retarded. The signal to begin was then given and the children were allowed to work for eight minutes. From previous trials this time was found to be adequate for practically every child; it is long enough for the older children to study out every picture and for the youngest to attempt all those within their ability.

Method of Scoring

A score of three points for each correct response was arbitrarily decided upon. Partial credits of two and one points were given for partially correct responses. Each deviation from the correct response was noted and recorded as it appeared. In this way a scoring guide was compiled; this is too lengthy to be printed here. In general it may be said that, when the missing part was inserted in the wrong place, a score of two was given; and when something else "that made sense" was added to the picture but the missing part was omitted, a score of one was given.

Results

The children in two hearing schools and in one deaf school were tested. Table I gives the percentile scores by age for the

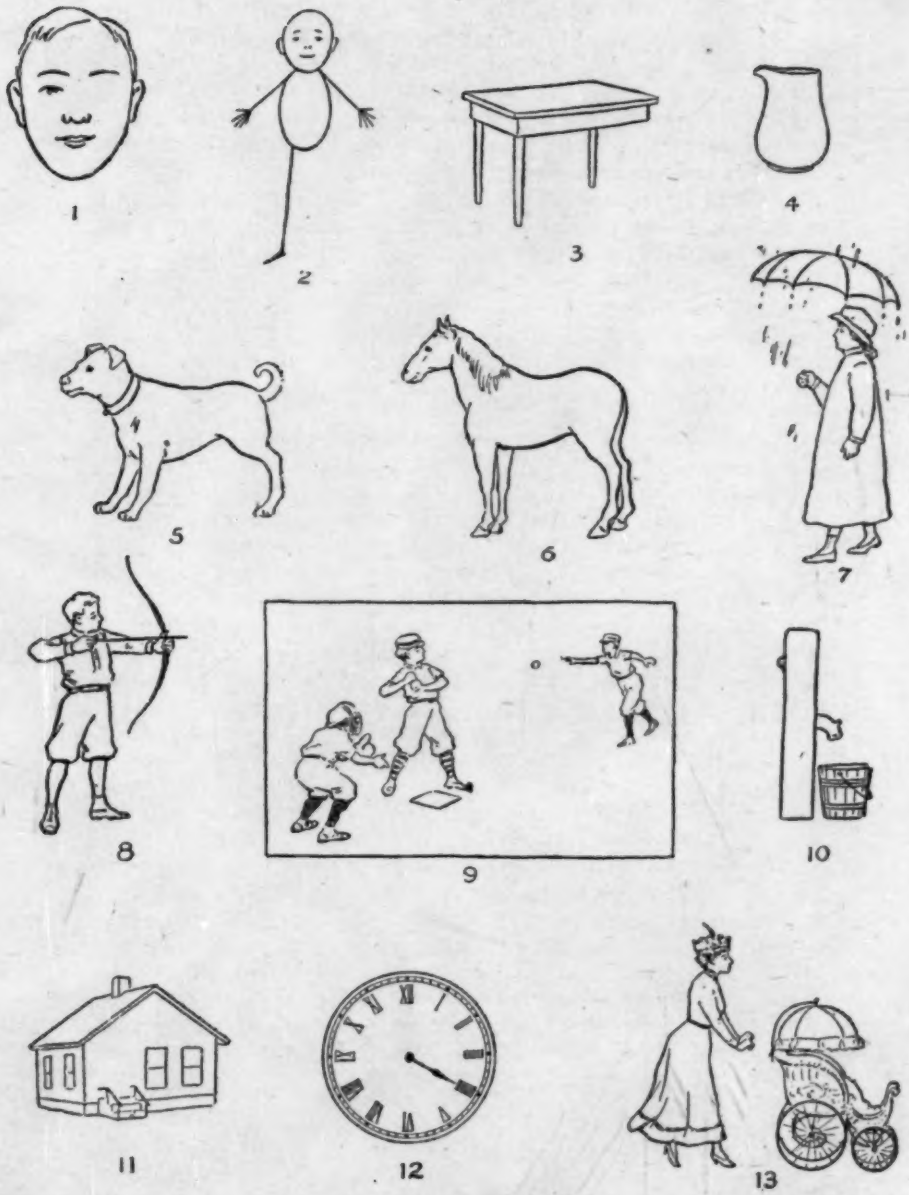

FIG. 1

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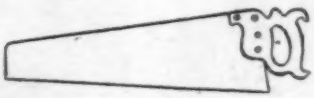

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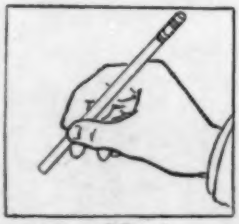

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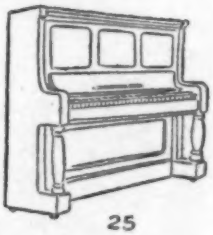

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TABLE I. PERCENTILE NORMS BY AGE.

	Age												
Percentile	5	6	7	8	9	10	11	12	13	14	15	16	Adult
100	44	68	69	70	74	74	74	75	75	75	75	75	75
90	43	56	63	67	71	72	73	74	73	73	73	74	74
80	28	52	59	64	69	70	72	72	73	72	72	73	72
70	25	46	57	62	67	68	69	70	71	71	71	72	71
60	23	41	54	61	65	67	68	69	70	70	70	71	70
50	18	38	52	59	64	65	67	68	69	68	69	69	69
40	16	34	50	55	63	63	65	67	68	67	67	69	68
30	16	32	47	52	61	62	64	65	66	65	66	67	67
20	6	24	43	48	57	59	61	62	63	63	65	67	66
10	2	17	36	42	52	55	57	60	60	58	62	66	63
0	0	0	0	2	25	31	36	48	45	39	36	62	60
No. of Cases.	15	107	124	142	184	160	136	103	113	143	82	28	60

hearing children. It will be seen that the median (the 50 percentile) increases rapidly from the lower to the higher ages. A distinct increase is present from age 5 to age 9, but from age 9 to age 12 the increase in score is only one or two points per age, and from age 12 upwards there is no increase in score. It would seem, therefore, that the test is discriminative from age 5 up to age 9 or, at most, age 12. This is also borne out by an inspection of the percentiles; from age 5 to age 9 there is a distinct increase in score between any two ages at any percentile; above age 9 the increase at any percentile is very slight and in some cases a decrease in score is noted. Obviously the test is too easy for children above age 10. It does not measure the differences in ability that probably really exist. In the last column of the table, the percentiles for 60 adults are given. Although these were University students, it will be noted that their scores are about the same as those of the 15 and 16-year-olds.

Table II gives the median scores for the deaf children as

TABLE II. MEDIAN SCORES OF DEAF AND HEARING CHILDREN.

	Age								
	8	9	10	11	12	13	14	15	16
Deaf	19	40	33	38	48	51	51	59	62
Hearing	59	64	65	67	68	69	68	69	69
No. of Deaf	4	13	7	15	26	24	10	16	23

compared with the hearing children. The great difference in ability which is shown is to be expected, judging from the results of other tests of deaf children. The median for the deaf does not increase steadily from age to age. The 13 nine-year-olds are probably above the average ability of nine-year-old deaf children, because the median is higher than the medians of both the 10- and 11-year-olds. The thirteen- and fourteen-year-olds have the same median score; more cases should be tested at these ages in order to see whether

TABLE III. PERCENTAGE DISTRIBUTION OF CASES MAKING PERFECT SCORES ON EACH PICTURE, BY AGES.

Picture Number	Per Cent of Cases Making Perfect Score at Age of:—													Order of Diff.
	5	6	7	8	9	10	11	12	13	14	15	16	Total	
1	47	79	92	97	99	98	99	98	98	100	100	100	95.7	2
2	80	92	97	99	98	100	99	99	99	99	99	100	97.8	1
3	20	54	62	74	86	81	89	88	91	97	95	95	81.3	8
4	27	45	57	67	81	82	86	85	91	95	96	90	78.0	11
5	20	44	63	70	76	89	86	93	93	94	96	100	80.0	9
6	27	70	77	90	94	96	93	95	94	99	98	95	90.0	4.5
7	13	58	68	74	80	82	85	93	96	98	98	100	82.0	7
8	0	3	8	9	13	18	17	31	27	33	28	50	18.3	25
9	0	12	28	37	55	66	68	63	77	66	67	60	53.6	19
10	33	67	80	87	95	96	93	97	97	95	98	100	90.0	4.5
11	20	36	53	55	72	78	79	78	88	89	91	100	71.5	16
12	0	24	39	55	59	48	52	53	61	59	65	70	51.4	20
13	33	76	88	93	95	93	96	96	91	92	94	100	91.2	3
14	7	7	9	30	52	58	57	68	73	77	71	85	50.1	22
15	0	41	62	66	77	82	86	80	82	91	93	90	75.6	13
16	27	35	56	63	81	83	79	86	93	93	95	100	76.4	12
17	0	24	42	66	83	81	87	94	88	90	91	85	74.4	14
18	0	16	32	55	64	61	62	72	69	71	69	80	57.5	17
19	0	31	51	58	74	79	82	89	88	92	95	100	73.4	15
20	0	7	10	14	41	46	56	54	61	62	67	50	40.7	23
21	7	40	70	76	88	93	90	92	92	91	90	95	82.2	6
22	7	10	29	43	56	65	66	70	72	81	84	85	57.2	18
23	27	25	60	69	85	86	90	96	88	93	96	100	79.1	10
24	0	1	9	16	30	43	47	53	57	51	59	80	36.0	24
25	20	21	34	39	48	61	59	73	72	63	75	65	53.4	21
No. of Cases	15	106	131	153	193	165	140	120	127	142	82	20	—	—

13- and 14-year-old ability on this test is the same or not. It would appear that the test may be discriminative for deaf children up to age 15 or 16.

Difficulty of the Pictures

A study of the number of children who are able to insert the missing part in each picture will give us a rough order of difficulty for the twenty-five pictures. In this tabulation we have only taken into account the number of children making a perfect score on each picture, that is, a score of three. No attention was paid to scores of two or one, and therefore our order of difficulty will not be accurate when partial scores are taken into account; it is, however, accurate enough for our purposes. Table III gives the percentage of children at each age making a perfect score on each picture. The next to the last column of the table gives the percentages for all ages combined; and the last column, the rank in order of difficulty of the pictures as determined by these percentages. It will be noted that some pictures are passed by a large percentage at all ages; others by a small percentage at all ages and others by an increasing percentage from the lower to the higher ages. Picture No. 8 is only passed by 18% of the total cases; this is the picture of the boy with the bow. A correct response to this calls for a line from the ends of the bow back to the hand; this is the only response that receives full credit. The vast majority of children drew a straight line from one end of the bow to the other end, which response only received a score of two.

The percentage of children passing each picture gives us an order of difficulty for the twenty-five pictures at each age. A correlation of the order of difficulty at each age with the order of difficulty for all the children combined will answer the question as to whether the order of difficulty at each age is roughly the same. The rank of each picture at each age as determined by the percentage making a full score was therefore calculated, and the ranking at each age correlated with order of difficulty for all cases combined with the exception of ages 5 and 16 which were omitted because of the small number of cases at these two ages. The correlations calculated according to the formula,

$$\rho = 1 - \frac{6\Sigma D^2}{n\,(n^2-1)},$$ and converted into r values are:

Age	6	7	8	9	10	11	12	13	14	15
r	.96	.98	.99	.96	.96	.96	.93	.94	.93	.90

These correlations are all so high as to justify the use of the rank obtained by the total number of cases for an arrangement of the pictures in order of difficulty.

A Short Test

An inspection of Table III shows that there are many pictures passed by about the same percentage of cases, which means that some pictures have the same degree of difficulty. Pictures of the same degree of difficulty serve merely to lengthen the test and do not give any added information as to the ability of the individuals tested. It would seem desirable, therefore, to throw away a certain number of pictures and make a shorter test. We have constructed a short test of ten pictures which we are planning to use as one of a series of group tests.

Using the percentages in the "Total" column of Table III as our guide, we have chosen the following ten pictures for the short test:

Picture Number	Subject	Per Cent of Total Making Perfect Scores
2	Man	97
10	Pump	90
7	Umbrella	82
16	Smoker	76
11	House	71
22	Foot	57
14	Violin	50
20	Elephant	40
24	Bicycle	36
8	Bow and Arrow	18

The total percentage of individuals passing these pictures decreases gradually from the first to the last indicating that the pictures all differ in difficulty.

These ten pictures, therefore, constitute our shorter Drawing Completion Test. Before re-scoring the papers to obtain norms for this shorter test, a simplification in the method of scoring was adopted. It was felt that a score of three points for each picture allowed the subjective judgment of the scorer too much scope. The new method of scoring allows scores of 2, 1 or 0 and is as follows:—

Drawing Completion Test; New Method of Scoring

A score of 2 for the correct thing in the correct place, with no attention paid to beauty of drawing.

A score of 1 if the correct thing is inserted but not in the right place.

A score of 0 if the missing part has not been perceived, even although some other non-essential but appropriate part is added.

The emphasis is upon the *perception of the essential missing part;* thus, in Picture No. 24, a line for a chain is considered fully as good as any elaborate drawing of links of the chain. A difference of opinion is only likely to arise with regard to the scores of 1 point. The following samples of what was allowed a score of 1 may serve as a guide:—

Picture Number.

2. Leg very much out of proportion. Leg unduly curved.
7. Handle visible through umbrella. Handle going to wrong place. Handle not grasped or unduly bent.
8. String of bow straight, not quite at ends, curved back, outside the bow, curved like the bow, or half of string only.
10. Handle not at proper place.
11. Door in wrong place.
14. Bow at tip of fingers and not grasped. Bow upright or down.
16. Pipe or cigar in mouth, balanced on finger tips, extending from mouth to hands.
20. Two ears.
22. Toe added at the wrong side.
24. Line for chain not going over sprocket wheel, one line only for half of chain, line from sprocket wheel to front wheel.

It is to be emphasized that no credit was given for the addition of other things to a picture, even although they might be very appropriate, unless the subject added also the essential part that is missing, the credit being given for supplying the essential part.

The total possible score for the ten pictures is 20. The median scores for each age are as follows:—

Age.....	5	6	7	8	9	10	11	12	13	14	15	16
Median Score	5	9	12	13	15	16	17	17	17	17	17.5	18

As in the original test we note again the failure of the test to discriminate between the abilities of the older children as was to be expected from the percentages passing at each age.

The correlation between the long and short test will, of course, be high in spite of the slight difference in methods of scoring. We have not considered it necessary to calculate

correlations for each age, contenting ourselves with choosing two ages, one fairly low and one fairly high. At age 6 with 107 cases, the correlation between the long and the short tests is .96, and at age 11 with 140 cases, .81. The coefficients for the other ages would undoubtedly be near these values.

The rank in order of difficulty for the ten pictures according to the new method of scoring differs somewhat from the rough ranking obtained under the old method when only maximum scores were considered. We have calculated for each picture the total number of credits made by all the children tested at each age, taking into account both full and half-credits. This gives us a rank in order of difficulty for each picture at each age. These total scores and ranks for each age are too lengthy to give here. Taking the average of the rankings for each age (omitting ages 5 and 16) we have a new ranking for the ten pictures which can be compared with the rough ranking previously obtained.

Picture No.	2	10	7	11	14	16	22	8	20	24
Av. Rank..	1.0	2.7	3.0	3.5	4.9	5.7	7.2	8.4	8.7	9.7
New Rank..	1	2	3	4	5	6	7	8	9	10
Old Rank...	1	2	3	5	7	4	6	10	8	9

The pictures of the shorter test should be arranged roughly in the new order of difficulty. Two or three minutes is suggested as a time limit; the new test contains only two-fifths as many tests as formerly. That time should be taken such that all but the most backward subjects will have time to attempt all ten pictures.

Conclusions

The Drawing Completion Test has proved useful and suitable for group testing purposes. It appeals strongly to all subjects. The kind of activity demanded is the same sort of thing as required by language completion tests and, since these latter have been found to correlate highly with tests of general intelligence, it may be presumed that the Drawing Completion Test will show a fair correlation. Because the use of the English language is not required in order to present the test or to take the test, it should be particularly useful in the testing of foreign subjects, deaf subjects and individuals whose language environment has been very much restricted. It would seem that the modified shorter form of the test is just as adequate as the original longer form. The shorter form would certainly be more desirable as one of a group of tests. The discriminative value of the test would seem to extend up to age eleven or twelve.

COMMUNICATIONS REGARDING "A PLAN FOR THE TECHNICAL TRAINING OF CONSULTING PSYCHOLOGISTS"

In the preceding issue of this JOURNAL[1] we submitted a tentative plan for the uniform training of consulting psychologists in the hope that it would arouse a widespread discussion and ultimately lead to some definite results. Up to the present writing a number of communications have been received in response to this appeal, from which we quote either in full or in part. The same topic is also treated more extensively in an article by R. M. Ogden in the present issue (pp. 179 ff.), describing "The Training Course for Psychological Examiners at Cornell University." In this connection we should also call attention to a Note on the American Association of Clinical Psychologists, by its Secretary Pro Tem., Mrs. Leta S. Hollingworth, in the present issue of this JOURNAL, p. 194, in which the urgency of the problems of training consulting psychologists is forcibly demonstrated. It is hoped that the generous response received thus far will stimulate others to continue the discussion in subsequent issues, so that we may arrive at a fairly representative view of psychologists regarding the problems involved, upon which to base a definite plan of action.

Professor Hollingworth of Barnard College writes:

"There are so many things to do these days that I have not been able to get at the discussion of your plan for training applied psychologists earlier. I cannot discuss it even now as fully as I should like, but the following comments may serve the immediate purpose.

"In the final chapter of APPLIED PSYCHOLOGY I have indicated that of the various ways in which institutional adjustment is to be made for more effective use of psychological attitude, content, and technique, the value of the adjustment will vary with its purpose. The most essential thing needed now seems to be the safeguarding of applied psychology. For this purpose it seems wise that effort be made to give the work of the applied psychologist, in whatever field, a dignified and professional status. Consequently, in place of beginning the

[1] L. R. Geissler, A Plan for the Technical Training of Consulting Psychologists. *Journal of Applied Psychology*, vol. 2, 1918, pp. 77-83.

standardization down in the freshman college year, it would seem to me more useful to begin with those doing graduate work. At present the fact that one has a Ph.D. in psychology in no way testifies to his ability as a clinical, educational, industrial or vocational psychologist. There are plenty of Ph.D.'s in psychology who have never seen a feeble-minded child at close range, never used an educational scale, never made a motion-study and do not know the meaning of 'labor turn over.' Why not begin by indicating, by means of some special diploma or certificate the special field of application in which the candidate may have knowledge. Instead of a blanket term, such as 'consulting psychologist,' I should, at present, favor some more specific set of titles, such as 'diploma in clinical psychology,' etc., no diplomas being conferred lower than the Ph.D. degree. To label the college graduate and the average M.A. candidate with the title 'psychologist' would for the present defeat the very purpose of the movement,—it would simply flood the market with people looking for jobs, and who would in no way contribute to the technical status of psychology. As time goes on it might be possible to confer the diploma of 'assistant,'—as 'assistant in clinical psychology,' etc., on M.A. candidates,—or it might do no harm to do that from the beginning.

"All of the preceding is on the assumption that for a great many years the status of the applied psychologist is to be similar to that of the chemist, pathologist, etc., in the modern factory and hospital,—the status of an expert in his own field. And before he can attain to this status he should already be an expert. But I take it that the time will come when instead of this arrangement the psychologist may develop into the psychotechnician, a sort of human engineer who is not necessarily limited in his work to the problems of one industry, hospital, or institution. When this time is reached some such special plan for training as you outline will be much needed, and I see no reason why the university departments should not be so organized as to provide this technical training, even though their main work must continue to be scientific rather than technical. Chemistry departments have been effectually organized so as to train the chemical engineer as well as the research chemist and the philosophical chemist. But I think that a broader and longer training is needed by the technical psychologist than by the technical chemist, so that although it may be appropriate to graduate the senior from college or engineering school with the title of 'chemist,' I should not favor similarly designating other seniors as 'psychologists.'

Your own plan for the course of study to be undertaken by the prospective technical psychologist seems to be well calculated to prepare the student for genuine technical and professional work in his graduate years. But I should not favor the granting of special diplomas until the work of those years has been completed.

"I am very glad that you are bringing the matter up for discussion in the JOURNAL OF APPLIED PSYCHOLOGY, and I hope that you find the interest sufficient to conduct a prolonged symposium from all the various points of view. The Association of Clinical Psychologists, which was originated at Christmas is at work on this problem in their own field, in which the matter is at present very urgent, and I hope that some of their active members may contribute to the symposium. My own ideas on the matter are at present rather tentatively expressed, and the symposium instigated by your own well conceived plan should do much to clarify them."

Dr. E. I. Keller, Consulting Psychologist, New York, writes:

"I have read your article on 'Training for Consulting Psychologists' with intense interest. The time is indeed ripe to prepare students for the work that is opening up for them in this department. As you suggest, the college courses should be chosen with care by those intending to elect such a profession. Off-hand I have two suggestions to make, first, as it takes a certain type, generally a mature mind, to wish to follow such a course, I think that most of the professional training as such should be taken *after* the B.A. degree is taken. Secondly, as a consulting psychologist needs much experience with individuals in the clinics, laboratories, or in business, the last degree should be preceded by years of experience in clinics in co-operation with pediatrists and neurologists, in business in co-operation with heads of employment bureaus, etc., and in analyzing the various occupations so as to choose aright the standardized tests for examinations of employees."

In a subsequent letter Miss Keller asks to add a third requisite. She wishes to "stress biology and anthropology, so as to force in consulting psychologists a genetic or biological point of view. This added to the mathematical training will help broaden and deepen their vision, and save them from being too exact and mathematical when the higher processes are to be considered."

Professor Scott, at present chairman of the Committee on Classification of Personnel in the Army, writes:

"The program which you have outlined is certainly most

excellent. The only suggestion I would make is that there might be some possibility of getting in more practice work to give life to the theoretical work; for instance, if the instructor is giving a course on psychology of advertising, he should attempt to serve as counsellor for one or more firms, and bring before the class from day to day the problems that actually arise in connection with that work. If the course were connected with mental hygiene the same practice should be employed. This kind of work should not be postponed to the days of strenuous work, but should come in from the very beginning."

Dr. A. H. Sutherland, School Psychologist of Los Angeles, writes in a preliminary way and promises a companion article for a later issue. He says in part:

"I like your article recommending a training course leading to three different degrees in Applied Psychology. I believe that there will be some difference of opinion regarding the items in the course, and the titles which you suggest seem to me to be too much alike, and perhaps of too fine a distinction to be practical. . . . Have you considered modeling the training after that of the certified public accountant? You of course have not overlooked the fact that in order to prevent others from using the name Applied Psychologist, it would be necessary to have legislation in each state, and a license issued."

Professor Strong of George Peabody College for Teachers and at present a member of the Committee on Classification of Personnel in the Army writes:

"I have just found time to read over your Plan for the Technical Training of Consulting Psychologists. I think it is very desirable to publish such an article at this time, but I am not at all sure that I agree with some of the details in the article. For example, the specific courses which you outline for the undergraduate to take are not altogether to my liking. I would much rather have them take considerable biology than some of the other things you mention.

"I think it is almost hopeless to talk about 'assistant consulting psychologists,' meaning thereby a man who has received his bachelor's degree. I do not believe I have ever seen a graduate of a college who knew enough of psychology to give any great practical value to any one. Why not deliberately say the assistant consulting psychologist shall be one who has had a five years' course? This would be in line with the best practices in the engineering colleges of the

country and would be more nearly in line with the procedure in medical and law schools. With a five year course we could supply the men with such training as would enable them to accomplish something worth while."

Professor Thorndike of Columbia University writes:

"I regret that the press of other duties prevents me from giving adequate consideration to the proposals concerning formal recognition of applied psychology or mental engineering, the provision of suitable degrees or diplomas, and arrangements for providing industry, business, social work and education with reliable experts and assistants for this work.

"In general I have much interest in improving university preparation for this work but relatively little interest in erecting formal distinctions between the charlatan and the scientific worker. That matter will, it is to be expected, largely take care of itself if an adequate supply of men and women competent at human engineering is available. The two main problems seem to be to enlist the interest of competent young men and women in this work and to decide how much of their university training shall be given to applied psychology itself and how much to the general understanding of business or industry or medicine or social work.

"I will not try to discuss the detailed program of the article except to note that our divisions between the Bachelor's degree, Master's degree and Doctor's degree seem peculiarly unfortunate in this case. About two years work in advance of the Bachelor's degree by a competent person who nevertheless lacks the high degree of scholarly and research abilities required for the Doctor's degree would seem to be about what should be expected for the standard diploma as psychologist. Engineering schools also very much need some degree to recognize two years work in advance of an ordinary engineering education. It seems, therefore, questionable whether we should submit to the traditional arrangement in this case."

THE TRAINING COURSE FOR PSYCHOLOGICAL EXAMINERS AT CORNELL UNIVERSITY

By R. M. Ogden

A year ago few psychologists would have been sanguine enough to predict that their active participation in the service of war would be apt to meet with the welcome and approval of military commanders. Under ordinary conditions, human inertia is too difficult to be overcome in a brief space of time. At a meeting of psychologists, held at Cambridge in April of last year, the question of applying psychological methods to problems of war was enthusiastically discussed, and tentative plans were formulated for carrying on such co-operative work as might be acceptable to the Government. Yet real as were the problems in the psychological field, and keen as were the psychologists to be doing their bit of service in their own professional realm, it was freely recognized that psychological technology was still in its infancy, and that among those who had devoted many years to psychology as a science, a conservative skepticism prevented a ready acceptance of all that the programs laid down by the applied psychologist seemed to embrace. Conservative psychologists were loath to enter the field of vocational guidance and individual analysis which many charlatans and 'character experts' had already more or less preempted, and preferred to bide their time until the foundations and methods of applied psychology had been more carefully tried out and perfected.

Then came the war, and with it the urgent need of grading and classifying thousands of men gathered from all parts of the country, and from all walks of life. Obviously, the job must be done, and better by far that it should be undertaken by men trained in the principles of scientific psychology, than by those who trusted only to intuition and haphazard guessing.

As is well known, the efforts of the psychologists who entered this service, and planned its methods and procedures, have been crowned with a large measure of success. Without undertaking to accomplish more than the present status of a scientific examination of mind by the approved tests of intelligence would warrant, they have demonstrated the value

of these methods, and the economy of such means in the selection and classification of recruits to the National Service. Realizing that a successful fruition to the plans of the Psychology Committee of the National Research Council would mean a heavy draft upon the body of trained psychologists competent to undertake this work in the field, and that there would be urgent need of newly trained men, both to supplement in the field and in the laboratories at home, the Departments of Psychology and Education at Cornell University co-operated in providing an intensive training course for prospective psychological examiners.

With the approval of the chairman of the National Psychology Committee, this course was planned to emphasize the broad principles of experimental psychology and to afford training in the theory and practice of mental testing. The courses that constitute the frame-work of this training are courses which have long been standardized in the two Departments in which they fall. The first is a three-hour course in Elementary Psychology that surveys the field and emphasizes the content of the subject and the general methodology of a scientific approach. This course has hitherto furnished the prerequisite for all advanced courses in both psychology and education. No student was admitted to the training course unless he had completed this course, or was registered for it. The second was a laboratory course in Experimental Psychology of three two-hour periods. The students perform a series of psychological experiments so planned as to give a general understanding of the problems and methods of investigation which a psychologist must have at his command. The third, a three-hour course in Educational Psychology, deals with the functional aspects of psychology; mental dispositions, traits of character, and general and special educability. Since the interests of applied psychology, and in particular the problems of sorting and classifying recruits, are all, broadly speaking, educational in their nature, this introductory course in the Department of Education was adapted to furnish an understanding of the constitutional equipment and the individual variations of human beings.

The culminating course of the schedule is the one in Mental Testing. Like the one in Experimental Psychology, this is a laboratory course, and is given in two periods of three hours each. In it the theory and practice of mental and physical measurements are studied, with special reference to the application of adult scales. The participants undertake both the administration of the tests and the valuation of

results. The theory of correlations, and the mathematical and statistical methods of handling data are emphasized. Although our clinical facilities at Cornell are somewhat limited, ample opportunity is afforded for practice in testing both individuals and groups of persons. The members of the course devise applications of individual and group tests, and then administer them to individuals and to classes of students in other courses of the two departments.

The scheme, in brief, is to provide an opportunity for properly qualified students to undertake intensive study along the lines mentioned, by permitting them to pursue simultaneously a number of cognate courses which under ordinary cooditions must be taken seriatim. No student is allowed to register for Mental Testing who has not taken, or is not taking, the three other courses normally prerequisite to it. Students who have already completed their prerequisites are advised to enroll for advanced work in psychology and mental testing, and likewise for certain relevant courses, such as the mathematics of probabilities and statistics.

The results of the first term's work were very encouraging. Seven male students completed the course and were recommended for "induction" into the National Service. All were senior or junior students in the College of Arts and Sciences. Some were registered for the draft, while others were under age. One, who completed his university course and received his degree at the end of the first term, was immediately inducted into the service. Others have been informed that they will be called in subsequent contingents to the psychological training camp at Camp Greenleaf. Ten men are enrolled in the course this term, and there are others engaged in advanced work. The course will be repeated during the summer session of the university, and has been announced for continuance next year.

Although the demands of the psychological examining corps are limited to the numbers required at the various training camps, there are other needs of the National Service which psychologists will be called upon to supply. The chief of these is perhaps in the field of re-education for the crippled and mentally shocked soldiers who return from the front as wards of the Nation. In England, and in other countries, work of this sort has been undertaken on a large scale. In it medical men, psychologists and educators, especially vocational experts, are co-operating. The organization of such a service has been authorized and is under way in this country, and psychologists, both men and women, are being asked to fit themselves for

this important task. Here, then, is another reason for encouraging properly qualified students to enter the profession of psychology.

The demands of the National Service, though important and pressing, are of course uncertain as regards extent and duration. But for other reasons it is felt that the encouragement of intensive work in the field of psychology is peculiarly desirable at this time. As previously mentioned, the draft of mature men, already trained in psychology, has been very heavy. In consequence, many of the laboratories throughout the country are so short-handed that they have been obliged to curtail their programs, and even temporarily to suspend advanced work. Steps must be taken to prevent serious consequences from such a slackening of effort. Not only must the training of psychologists go on to supply the needs of Government Service, but the needs of the laboratories must be satisfied in order that both training and research may be continuously fostered.

There is also a special aspect of our work which cannot be neglected. Psychologists are demanded more and more in the educational, commercial and industrial fields. The successful venture of the psychologist in the ranks of the army will add measurably to his prestige in the pursuits of peace. Legislatures are already busily enacting laws which necessitate the mental examination of school children and wards of the state, and which imply subsequent segregation and special training for the deficient and the delinquent. One state already requires that its psychological examiners shall be members of the American Psychological Association, as an evidence of fitness for their work. Yet the membership of this association scarcely numbered three hundred before the war. Likewise in business, industry and agriculture, vocational experts are in demand. In the institutions for the feeble-minded, the insane, the blind, the deaf and dumb and the criminal group, psychologists are increasingly employed to fill important posts. We cannot but anticipate a large growth in the number of men and women who will find a professional calling in this field. It would therefore be a great mistake to relax any effort in holding the university courses of psychology at the highest level of efficiency and thoroughness, despite the inroads made by the exigencies of the war. Requirements once made by institutional boards or by legislative enactment are not lightly to be set aside. If the body of trained psychologists is unable to furnish men and women adequately equipped for the work at hand, we shall

find other persons of inferior training and with unscientific methods ready to undertake in the name of psychology a work for which they are in no wise properly fitted.

Therefore, in advocating and in planning an intensive training course of psychology as a temporary measure of expediency, we at Cornell have had in mind, not alone the Government service, but also a demand which bids fair to outlive the needs of war, and to bring to the psychologist an extra-academic status of great significance in the welfare of our common life.

In conducting this work we have emphasized from the start a thorough training in the purely scientific aspects of psychology. It has been our conviction that a sound technology can be reared only upon foundations that are theoretically assured. It is not enough that one should know the technique of administering tests and computing results. To be competent as an expert one must understand both the structure and the functional growth of mind, and be intelligently conversant with the broad principles of scientific observation. We have therefore insisted that no recommendation should be given to students who have not successfully pursued fundamental courses of psychology, both theoretical and experimental. It appears to us that a real danger lurks in the enthusiasm which may prompt applied psychologists to advocate a brief training in the administration of mental tests as being quite sufficient for most practical purposes.

It has been gratifying to learn that the experience of those in charge of the field work in the Army vindicates the position we have taken. In this connection I may perhaps be privileged to quote from a letter of Major M. E. Haggerty of the National Psychology Committee. ". . . I should say," he writes, " that the most desirable thing for universities to do at this time is to lay emphasis on the fundamental courses, so that we shall have coming on a generation of men and women grounded in the fundamental subjects of psychology. Among these I should of course list general, experimental, abnormal, social and educational psychology. A man who is thoroughly grounded in these fundamental subjects, who has learned to attack his problems scientifically, and who has had some direct contact in dealing with hospital or educational situations from the standpoint of psychology, will be very quickly trained in the specific uses of his knowledge which will be demanded in psychological service. A thoroughly trained experimentalist with a clinical point of view will acquire in a very short time the technique of giving

tests, and this technique we can give him with much greater ease than we can give him the fundamental training." Major R. M. Yerkes has also expressed himself in a similar manner.

Indeed, the experience of the men who are directing the field service of psychologists seems to be that a theoretically trained mind is able to carry over into the technical work habits and points of view conducive to accuracy, circumspection and a general resourcefulness which are too often lacking in those whose training has been largely technological, and therefore superficial. To an instance of this sort my attention has been called recently by the conclusion reached by a faculty of engineering in regard to the work and attainments of their students. In planning their courses so as to provide the greatest amount of information and technical skill within the time allotted to them, they have found that while achieving a smoothly running course into which students fit themselves with an "efficiency" that rivals the automatic assemblage of parts in a Ford automobile factory, they have ultimately succeeded in stifling the initiative of their men. It is the opinion of these instructors of engineering that their Sophomore students, whose work has been chiefly in the "pure" sciences of mathematics, physics and chemistry, show more initiative in their work than do the Senior students who have progressed into the technical phases of the course. Eventually the student becomes a first-rate workman, capable in the use of tools and materials when explicit directions are given him. But he lacks resourcefulness in meeting new situations. He lacks self-reliance, for he has never been placed upon his own responsibility, nor has he found either leisure or encouragement to develop and exploit his own ideas.

In a field like engineering where materials and methods are so largely standardized, the result is not altogether bad. At least, such a school may be expected to turn out good workmen, well-informed and capable within the range of their special training. But at best the product is that of the trade school, which is not primarily concerned with the cultivation of scientific intelligence and leadership. How many individual talents may be blunted by such a process, it is difficult to say; but lacking the true spirit of research, such training cannot be of the sort that comports itself well with the idea of a university.

However desirable it might be to have a large number of mediocre though competent psychological technicians, who can "follow directions," the time has not yet come when we may regard any such training in the psychological field as

adequate. Psychology is still an experimental science in all its departments. To make a proper use of its data, to avoid errors that may have wide-spreading evil effects, psychological work must remain in the hands of persons broadly and adequately trained in its fundamental principles.

But the implications of this distinction of pure and applied science are still more widely applicable. It would appear that we have here another argument favoring the intensive pursuit of science in the universities. To understand the principles of a science, to be able to think in terms of research, is to become an adaptable and a self-reliant type of person. Whatever one does later in life, it is such persons who make good citizens; for they have come to think things through, and to rely upon principles which they accept with conviction, rather than from compulsion, or because "the book so states." A scientifically trained citizenry is more reliable in time of stress than one that is only technically trained, despite the greater amount of special knowledge which the latter may possess. It is perhaps because we of the universities have not sufficiently realized this fact that we have been so prone to allow our traditions to lapse as we make way for all sorts of courses in technological training without seeing to it that adequate foundations have been laid. At any rate the indictment that we *train* men and women without *educating* them is not lightly to be set aside.

In the field of psychological technology we must be especially alive to the danger of erecting an imposing superstructure without first laying a secure foundation, for we should remember that we are applying our tests and measurements to human beings whose very careers are at stake. Unless we enter upon this task with open-mindedness, sound judgment and a resourceful methodology, we shall only make a mess of it. In attempting to meet the urgency of the extraordinary conditions thrust upon us by the war, we at Cornell feel the importance of advocating that in each and all its varied aspects, applied psychology should be closely tied to the fundamental principles of the science. So long as this is done we may confidently hope that the applications of psychology to the business of life will be held firmly in the grasp of those best fitted to make them.

BOOK REVIEWS

DARWIN O. LYON. *Memory and the Learning Process.* Warwick and York, 1917. p. 180.

The author has suggested in the preface of his book two dominant motives, first, to present the general experimental material upon memory with special reference to this specific topic: "The Relation of Quickness of Learning to Retentiveness;" secondly, to discuss the memory process from an educational point of view, trusting that the conclusions drawn from the experimental data may be of some practical use to the teacher.

The general scope of the work may be shown by the chapter headings: Chapter I, On the Forms of Mental Activity; Chapter II, The Subdivisions of Memory in General with Special Reference to Their Relations to the Learning Process; Chapter III, The Relation of Length of Material to Time Taken for Learning and the Optimum Distribution of Time; Chapter IV, The Relation of Quickness of Learning to Retentiveness; Chapter V, The Educational Value of Psychological Research with Special Reference to Economy in Learning and Mnemonic Systems. Chapters I and II are largely devoted to the definition in the broader sense of the various aspects of the memory problem. This is not a mere compilation of the results of the work of different authors but the material is carefully analyzed and evaluated by the author with the statement of problems yet to be solved. Chapters III and IV, in the opinion of the reviewer, are by far the most valuable part of the book. In the first of these two chapters the author makes his greatest contribution. He gives the results of his own experiments covering a period of ten years and indicates and explains the various methods used by a series of eleven charts found in a pocket on the inside cover of the book. About all the other available experimental work upon this topic is carefully examined and several inconsistencies pointed out. "The curve of forgetting which has developed from Ebbinghaus' experiments upon nonsense syllables has given us what is sometimes known as Ebbinghaus Law." The results of the experiment were based upon his work with 24 nonsense syllables and covered but three experiments. Those for 36 nonsense syllables were based on only two experiments. With Ebbinghaus there was a relative increase of repetitions with an increase in the number of syllables memorized, while with some of the more modern investigators, such as Meumann and V. A. C. Henmon, the results show that there is a relative decrease in the number of repetitions with an increase in the number of syllables (p. 52). "The 'Once Per Day Method' on the whole appeared the most economical, but because of certain notable exceptions and the great amount of individual differences, Dr. Lyon concludes that the problem in its final analysis be stated "not in what is the most economical method of learning but what is the most economical method for Mr. Smith or Mr. Brown and how can they find this method out."

The Educational Value of Psychological Research with Special Reference to Economy in Learning and Mnemonic Systems is the title of Chapter V. This contribution seems to add little to the

value of the book. The author apparently believes that there is of necessity and always will be considerable difference between the problems and methods of work of the pure psychologist and of the applied psychologist. It may even seem that in a few cases he sets up difficulties as we sometimes set up straw-men for the mere pleasure of knocking them down. It is of interest in this respect to note that experimental psychology is performing at present its best services in the fields of business, education, medicine and other applied work. The book as a whole is a distinct contribution to experimental psychology and in addition furnishes one of the best compilations of the available material upon memory. JAMES M. O'GORMAN.

W. S. ATHEARN. *Religious Education and American Democracy.* Boston and Chicago: The Pilgrim Press, 1917, p. 394.

The author of this volume pleads for a democracy of religiously educated people. And "one thing is clear to those who are closely in touch with the present tendencies, and that is that the United States will have a system of moral training for her people before ten years" (p. 12), either in the form of ethics or in the form of religion proper, and the form will be determined by the "attitude of the church people of this country during the next ten years." To complete our educational system we must build "a system of church schools closely coordinated with the public schools" (p. 14), supported by the church and consisting of three parts: the school for all, the training school for teachers, and the supervision. "It is the task of the schools to make democracy safe for the world."

In the chapter on *Correlation of Church Schools and Public Schools* the author discusses the three general methods proposed for the teaching of religion: 1. Teaching religion in the public schools; 2. Establishing parochial schools; and 3. Coordinating the two kinds of schools into a unified educational system.

While the reading of passages from the Bible would not be seriously objected to in the public schools, many would maintain that that is not religious education, and to engage teachers to teach religion in the schools would be a serious undertaking. Secular education should be received in secular schools and religious education be taken care of otherwise.

"Two things are clear (1) that the church must teach religion and (2) that it must do it outside the public schools" (p. 19), and it must do it in such a way as "to preserve the unity of the educative process. Three methods have been proposed for achieving this result" (1) Church vacation schools. (2) Academic credit for religious instruction under church auspices. (3) Week day religious schools sharing the child's time with the public schools.

Church vacation schools began as early as 1866 in Boston and have now an association of 339 schools, 2,731 teachers, and 73,058 pupils, costing 79 cents per pupil for six weeks instruction (1915). The American Institute of Religious Education has also held several schools during the past years, as have also other denominational bodies, with apparent success.

The problem of academic credit for religious instruction has become a real one, since we are beginning to recognize that the public schools are not the only educational agencies in the community and since the public schools demand so much of the child's time and energy that there is not time for music, art, etc., outside the required curriculum.

Bloomington, Illinois, High School gives credit for work done in music outside the school (eight out of thirty-two required for graduation). And in "Webb City, Mo., two semester credits may be made outside of the school under private teachers" (p. 62).

Chairs for religious instruction have been privately maintained in connection with the State Universities of Iowa, Kansas, Missouri, Michigan, North Dakota, Illinois, at Creeley College, et al. And credit has been given in high schools for religious instruction given outside the school. In North Dakota the state actually conducts an examination of students in Biblical subjects, the work being done outside the schools; in Colorado the state establishes conditions and approves of the work of an outside examining board; in Virginia the above two plans are combined. In Birmingham, Ala., and in Oklahoma credit is given in the elementary grades for work done in church schools and Bible classes. The credit usually given varies from *one-half* to *one*. The weakness of the plans is that the credit and promotion are granted solely on examinations conducted mostly by a second person, not by the teacher, and marked by a third person.

The standardization of Biblical courses would go a long ways towards solving the problem, and it belongs rightly to the church college to make such a standardization; this the church college has failed to do.

"No education is complete which ignores the religious element." But as the public school does not furnish this, and as the Sunday session of the church school is not adequate for the purpose, the church must have a share of the week days for religious instruction. Two plans have been developing for the solving of this problem. 1 The Wenner plan, which provides that the schools close every Wednesday afternoon, leaving the children free for religious instruction, and 2. the Gary plan, which, on account of the freedom that it allows the child, gives him an opportunity for religious instruction. This instruction takes place mostly in a church, where a teacher may instruct various grades successively during the day. The Gary system has not been very favorably looked upon at Gary, imposed as it was from without, but it is introduced in several schools in New York City.

At Malden, Mass., a new system has been started, which looks at the problem from the point of view of the community; it is in successful operation.

In the chapter on *Unification* the author discusses the relative merit of several Sunday School organizations and comes to the conclusion that "there is unnecessary duplication and great economic waste. . . .Some agencies must leave the field to those that can do the work better; other agencies must be united into more effective cooperation."

In the colleges which do not teach religion the voluntary student associations have proved inadequate to the task of imparting religious education to the student. And "the only colleges that could legally give religion an adequate place in the curriculum have failed to do so." "The heart of a church college should be its departments of Biblical History and Religious Education."

In the graduate schools "very few courses are offered in religious education . . . I know of no graduate institution which is taking its department of religious education seriously." They "have been without prophetic vision."

The book is an excellent review of the present condition of religious

education and of the attempts made to bring about a better state of affairs. The references to the literature of the subject are really remarkable.

KARL J. KARLSON.

HORACE SECHRIST. *An Introduction to Statistical Methods.* The MacMillan Company, New York, 1917, p. 482.

This is *A Textbook for College Students, A Manual for Statisticians and Business Executives,* as the sub-title reads, which is "non-mathematical," and in which "the illustrations, for the most part, are drawn from economic and business fields." Although "the methods discussed are of general application," the point of view from which they are discussed is frankly that of a student of economics, and in particular, of business organization and management. Any student of statistics, however, will find in the volume much useful information and advice on such topics of general interest as the limitations of the statistical method, common sources of error in statistical arguments, averages as "summarizing expressions," methods of presenting statistical results, etc.

"The order of treatment," which "is the same as that followed in the planning and analysis of a statistical problem," is indicated by the chapter headings: 1. The meaning and application of statistics and statistical methods, pp. 1-13; 2. Sources and collection of statistical data, pp. 14-58; 3. Units of measurements in statistical studies, pp. 59-77; 4. Purpose of a statistical study of wages, units of measurements, sources of data, schedule forms,—illustrations of methods, pp. 78-115; 5. Classification, tabular presentation, pp. 116-157; 6. Diagrammatic presentation, pp. 158-192; 7. Graphic presentation, pp. 193-233; 8. Averages as types, pp. 234-293; 9. The principle of index number making, pp. 294-331; 10. American price index numbers described and compared, pp. 332-376; 11. Description and summarization, dispersion and skewness, pp. 377-424; 12. Comparison, correlation. The material is thoroughly organized, and the development of the subject is kept constantly before the reader by the device of introducing each chapter with a brief statement showing the relation of the material in it to what has preceded, and by concluding each chapter with a summary of the contents. There are excellent indices of subjects and of proper names. Representative references to the general literature of the subject are given at the end of each chapter.

The order of treatment involves, in the earlier chapters, notably in chapter 2, the presumption of an appreciation of statistical problems which may be reasonable in the case of those who will use the book as a work of reference, but scarcely seems justifiable in the case of an undergraduate who is making his first formal approach to the subject. A lack of accuracy of statement which characterizes the book elsewhere, is especially in evidence in the strictly mathematical sections. For example, the discussion of "weights chosen at random" (pp. 242-246) leaves much to be desired, especially in the light of a statement in the summary on page 290. On page 384 we read "If the arithmetic mean is used, and signs are considered, the differences" (i.e., deviations) "are equal to zero," where aggregate or algebraic sum of the differences is clearly meant. As a whole the book is notable for the emphasis upon those preliminary steps in any statistical study which must precede a mathematical analysis of the data and the institution of any comparisons based thereon.

C. E. MELVILLE.

JOHN M. BREWER. *The Vocational-Guidance Movement, Its Problems and Possibilities.* The MacMillan Company, New York, 1918, p. 333.

This timely volume is the best summary of the history, problems, difficulties, and possibilities of the movement toward vocational guidance that has come to hand. At the same time it is critical and constructive and manifests a wide knowledge of the literature on the subject.

The author's standpoint may be gathered from the following statement in his Preface: "If the movement for vocational guidance has so far proved but one thing, it is that the indefinite education for the vague thing called 'complete living' or 'physical, mental, and moral development' must give way to a well-considered aiming at specific needs—needs such as those represented by the individual's right, duty, and desire to fulfill family relationships, to vote intelligently, to maintain a good standard of living, and to coöperate in all phases of endeavor for human good. These specialized trainings are by no means narrow; it is the indefinite education which has been narrow." He defines vocational guidance as "a systematic effort, based on knowledge of the occupations and on acquaintance with and study of the individual, to inform, advise, or coöperate with him in choosing, preparing for, entering upon, or making progress in his occupation" (p. 228), and he refutes those who limit it to mere efforts of placement, or to the time of leaving school, or to merely practical or merely idealistic aims, or to restricting a child's ambitions, or to prescribing vocations on the basis of psychological classifications of children into types. He distinguishes it from educational guidance on the one hand and from vocational education and vocational training on the other hand, and thus clarifies many issues that have been confused or misunderstood. The history of the movement in the United States is traced in detail from the earliest efforts by Frank Parsons until the present day; a few earlier efforts and work in other countries are treated perhaps too briefly.

A most suggestive chapter shows how educational guidance can be utilized to a much greater extent than is done now, by means of the regular school curriculum, and how club and other activities as well as continuation and prevocational courses can be made more helpful in this respect. The problems of vocational counseling by parents, teachers, professional counsellors, employment or placement bureaus and other agencies, their advantages and disadvantages, and the need of more coöperation between the school authorities and industrial and commercial associations, such as chambers of commerce or the like, are sharply delineated. Of special interest to psychologists is the author's discussion of "pseudo-guidance" in which he includes mainly the vocational efforts based on mental tests and psychological classifications of individuals and types of mind. He criticises the experimental work or claims of such investigators as Hollingworth, Lough, Puffer, Schneider, Scott, Woolley and others and holds that "the psychologist may help vocational counsel best by aiding in the improvement of the school examinations in the various subjects: the laboratory should be the schoolroom and the exercise the regular work of the class. And he may help civil service commissions and business establishments in devising standardized tests based on the actual work the employees will be called upon to do" (p. 161), and adds the following footnote: "Scott's 'Salesmanship Test' tests general cleverness,

but has little relation to salesmanship. Seashore's tests for musical ability are profitable as showing what may be done in fields requiring a high order of specialized ability. The testing now going on in the army at public expense has yet to prove its value." The reviewer is inclined to agree with many of these criticisms in so far as they are a warning against overconfidence in mental tests, although the author seems to have misapprehended the spirit in which they are undertaken by the very people whom he cites, while his implicit assumption that any given aspect of mental life or human conduct cannot be measured in terms of any other aspect seems to be well supported by the logical concept of measurement.

The sixth chapter outlines the need for further investigations of such questions as "(1) Why do children leave school? (2) How do they obtain work? (3) What kind of work do they do? (4) What are the opportunities offered by their work? (5) What proposals have been made to remedy existing evils?" (p. 179). A brief chapter on the problems of employment is followed by a detailed and most suggestive presentation of "a program for vocational guidance," which occupies practically the last fourth of the book. It offers a list of 64 activities, divided into 9 groups, which should be opened to pupils between 12 to 16 years of age, including the regular course of study and adding among others such activities as janitor work, fire department, sanitation committee, gardening, care of animals, dairying, painting and finishing, jewelry, bookbinding, printing, etc. One notable addition among these activities is the proposed life-career class, which is designed to begin as early as the fifth grade and to "aid the child to survey his opportunities, to decide on his career, and to prepare for his vocation" (p. 266). The children should be taught early to utilize various sources of information, to gradually prepare a survey of the field of occupations, to visit and observe people at their work, to analyze certain vocations and to examine their own characteristics as measured by concrete requirements. This life-career class should continue also in the colleges. The chapter makes many other recommendations, especially for coöperation between the school and all such agencies as come in direct contact with the human aspects of industry, commerce, agriculture, legislation, and the like. The whole program is finally summarized into eleven main recommendations, and the most appropriate immediate steps for inaugurating it are briefly stated. A bibliography of sixteen pages and an appendix containing problems and questions for class discussions on each chapter make the book a valuable aid for purposes of self and class instruction. L. R. G.

RUDOLF PINTNER and MARGARET M. ANDERSON. *The Picture Completion Test.* Educational Psychology Monographs No. 20. Warwick and York, Inc., Baltimore, 1917, p. 101.

This monograph describes the method of standardizing Healy's Picture Completion Test (The Farm-yard) on the basis of results from over fifteen hundred subjects varying in age from 5 years to adulthood. Healy's instructions were used and "an exact record kept of every move made by the examinee" as well as of the time required for completing the test. Each person was tested individually under most favorable conditions. The method of scoring, however, differed entirely from Healy's, being based upon the actual frequency of each correct or incorrect move made by the subjects. Of the nine possible correct moves the one which was done by the fewest number and

therefore considered the most difficult of all was given the highest score, namely 100 units, and the other correct moves received scores in inverse proportion to the percentage of recorded cases, the easiest being scored 52 units. The errors were rated proportionately lower, a score of 1 unit denoting that between 1.5 and 2.2 per cent. of the subjects made this incorrect move. All less frequent moves were disregarded, so that the final table represents only 61 out of 423 possible moves; and the highest or perfect score amounts to 646 units.

By comparing different age groups with each other and with the total group of subjects it was found that "the relative ease or difficulty of the moves is pretty much the same for any age-group," and "that no particular injustice is done to any age by the method of scoring adopted." Accordingly, the authors computed age-norms and percentile norms for each age which can be used for purposes of a year scale, a point scale, or a percentile scale. They also found that the test is of equal difficulty for both sexes and that children from a good or medium social environment score somewhat higher than children from a poor environment. Likewise the pupils who were accelerated in their school work obtained higher scores than the retarded pupils. As compared with other ways of scoring the new method enables one to make much finer differentiations and to obtain truer values. The time element seems to be of no diagnostic value, although the authors recommended that Healy's five-minute limit be extended to ten minutes. The more or less uniform increase in the median number of units scored from year to year makes the test appear of much significance and greatly enhances the value of the author's work in standardizing this important test. L. R. G.

The following books and pamphlets have been received:[1]

MAURICE PARMELEE. *Criminology.* The Macmillan Company, New York, 1918.

WILLIAM A. WHITE. *The Principles of Mental Hygiene.* The Macmillan Company, New York, 1917.

WILLIAM HEALY. *Mental Conflicts and Misconduct.* Little, Brown, and Company, Boston, 1917.

AUGUSTA F. BRONNER. *The Psychology of Special Abilities and Disabilities.* Little, Brown and Company, Boston, 1917.

JOSEPH JASTROW. *Character and Temperament.* D. Appleton and Company, New York, 1916.

ARTHUR JAMES TODD. *Theories of Social Progress.* The Macmillan Company, New York, 1918.

MAXIMILIAN P. E. GROSZMANN. *The Exceptional Child.* Charles Scribner's Sons, New York, 1917.

JOHN EDGAR COOVER. *Experiments in Psychical Research.* Leland Stanford Junior University Publications, Psychical Research Monograph No. 1, Stanford University, California, 1917.

[1] Mention here does not preclude further comment.

EDWARD SAFFORD JONES. *The Influence of Age and Experience on Correlations Concerned with Mental Tests.* Educational Psychology Monograph No. 22. Warwick and York, Baltimore, 1917.

LEWIS M. TERMAN, GRACE LYMAN, GEORGE ORDAHL, LOUISE ELLISON DAHL, NEVA GALBRETH, and WILFORD TALBERT. *The Stanford Revision and Extension of the Binet-Simon Scale for Measuring Intelligence.* Educational Psychology Monograph No. 18. Warwick and York, Baltimore, 1917.

JUNE E. DOWNEY and EDWIN B. PAYSON. *Unidextrality and Mirror-Reading.* Reprinted from *Journal of Experimental Psychology,* vol. 2, No. 6, 1917, pp. 393-415.

J. E. WALLACE WALLIN. *Feeblemindedness and Delinquency.* Reprinted from *Mental Hygiene,* vol. 1, 1917, pp. 585-590.

——. *The Phenomena of Scattering in the Binet-Simon Scale.* Reprinted from *Psych. Clinic,* vol. 11, No. 6, 1917, pp. 179-195.

——. *Wide Range versus Narrow Range Binet-Simon Testing.* Reprinted from *The Journal of Delinquency,* vol. 2, 1917, pp. 315-330.

The American Journal of School Hygiene, vol. 2, March, 1918.

The Journal of Educational Psychology, vol 9, Dec. 1917.

The Macmillan Company, *Notes for the Guidance of Authors,* 1918.

NOTES

The American Association of Clinical Psychologists was organized at Pittsburgh, on December 28, 1917. The membership includes men and women holding the doctorate in psychology, who are engaged in the clinical practice of psychology in the United States. The forty-five charter members are chiefly directors of clinics, of bureaus of child welfare, of institutional laboratories; in army service, as mental examiners of officers and recruits; or connected with courts, hospitals and schools.

The objects of the Association are to promote an *esprit de corps* among psychologists who have entered the practical field, to provide media for the communication of ideas, to aid in establishing definite standards of professional fitness for the practice of psychology, and to encourage research in problems relating to mental hygiene and corrective education.

DEPARTMENT OF PSYCHOLOGY IN THE LOS ANGELES PUBLIC SCHOOLS.

Los Angeles, long recognized as a leader in educational affairs, has taken another step in the direction of better education. Under the leadership of Dr. Albert Shiels, formerly Director of the Bureau of Reference and Research in New York City Schools, there has been created a Division of Psychology at Los Angeles to undertake an intensive and scientific study of the progress of types of children,—to be applied to the problems of over age, over-size pupils, the promotional system, the minimum essentials for school work, and provision of exceptional children both retarded and advanced. Dr. Arthur Howard Sutherland of Yale University was selected to organize this division and carry forward the researches in educational psychology.

Perhaps the most obvious type, from an administrative standpoint is the retarded child, and before any administrative action can be taken it is necessary to know about how many there are in the school system. Therefore a survey was undertaken in twenty-four elementary schools in which about 1200 pupils were tested individually by psychological tests including the Binet (Goddard 1911 Revision). With these records there were gathered also the health records, the school records, the attendance records, and some items regarding the playground and manual abilities. The results show that in ungraded rooms in Los Angeles, the percentage of children retarded mentally three years or more is 70.4%; that the percentage of mentally retarded three years or more among those children who were not promoted at the February examinations in 1917 is 34.6%; that in the Parental Schools the percentage is 81%. If the schools selected are in any way typical this would seem to indicate that there are in the school system in Los Angeles something over five thousand children whose mental age shows a retardation of three years or more.

The next step in the administrative problem is to determine the individuals, their location and their mental level. Since it is impossible for one psychologist to spread himself among 90,000 school children, it became necessary at once to consider to what extent teachers

and principals can be used to contribute the necessary data. It was found that a considerable number of teachers have undertaken to attend special classes and are already using some of the tests of the laboratory. Many of them have heretofore posed as psychological experts, after a short course at some one of the prominent training centers. It was therefore considered advisable to announce that these psychological tests are on exactly the same basis with an examination in arithmetic, reading, spelling or other school activities, and everyone should use tests regardless of training. It is hoped by this means to establish the point that the tests are no better than the person who uses them, and that if used by the teacher for her own information in teaching; that is, to guide her to methods of presentation and quality work expected that they will be an invaluable aid to intelligent instruction. At the same time, the point is emphasized that these by themselves will show no more regarding feeble-mindedness than do tests in arithmetic, reading, etc.

Over one hundred teachers have enrolled in a special course in experimental psychology. In this course no tests are being taught. The course as outlined is a training course in laboratory psychology, designed to lead the student to make simple psychological analyses, and interpret her own observations in psychological terms.

At the same time the teachers are gathering together in small groups to learn to do the Binet Test and are sent out to test *normal children only*. It is also announced firmly and widely that the performance of the Binet does not constitute one a psychologist.

Meanwhile plans are going forward to teach the better class of teachers to make "case studies" which shall include five steps.

1st. Family History.

2nd. Economic and Social Environments.

3rd. Physical Measurements.

4th. Mental and Psychological Measurements which include school room tests both group and individual.

5th. The Principal's and Teacher's estimates from sloyd, playground, etc.

It is planned as soon as possible to carry out this organization and collect at a central office this fall data regarding each exceptional child.

Meanwhile ten special rooms have been established in which to carry on teaching experiments on backward children. It is possible to select special teachers who have had some psychological training, and a certain measure of success has attended the experinment. Some of the children diagnosed as feeble-minded have made progress in comprehension, others have not, and it is a question whether the expense necessary is warranted.

The case study method is expected to discover also the gifted children, children who are gifted in special subjects. also those retarded in special subjects, and those who show peculiar interests, abilities and dispositions.

The value of the Division of Psychology at Los Angeles has already been recognized in connection with the Juvenile Court, the Probation Department, the Civil Service Commission, and the Employment Agencies, to say nothing of music teachers, and special schools of the vicinity. It is expected that another year will show wide spread coöperation among many interests to educate parents, and teachers to a much higher standard of demand upon the schools.

Professor John Wallace Baird, Clark University, one of the editors of this *Journal*, has been appointed Vice-Chairman of the Psychology Committee of the National Research Council. His address is 1015 Sixteenth Street, N. W., Washington, D. C.

At its last annual meeting in Pittsburgh, December 1917, the American Psychological Association authorized the appointment of a permanent Committee on Publications in Applied Psychology. The following constitute this Committee: H. L. Hollingworth, James Burt Miner, Walter D. Scott, Edward K. Strong, Jr., and L. R. Geissler, the latter acting as Chairman.

For the duration of the war the Committee has decided to carry on its work in the following way: It will examine the publications in applied psychology or pretending to belong to this field and publish the titles of such works in the *Journal of Applied Psychology*, and perhaps in one other psychological periodical, over the initials C. P. A. P. Any of these works that may be reviewed by members of the Committee at some later time will be marked: "*pro tem.* C. P. A. P." Such reviews will also be published in the *Journal of Applied Psychology* over the same initials. Copies or at least complete titles of publications suggested for examination by the Committee may be sent to the chairman, Dr. L. R. Geissler, Clark University, Worcester, Mass.

Dr. Guy Montrose Whipple has resigned his position as Professor of Education at the University of Illinois to accept a position at the Carnegie Institute of Technology as Professor of Applied Psychology and Director of the Bureau of Educational Research. Pending the return to the Institute of Dr. Walter D. Scott, now serving at Washington as Chairman of the Committee on Classification of Personnel, the development of the new Bureau of Educational Research, which is aimed to investigate those pedagogical problems that arise in the work of the Institute and that offer hope of solution by experimental or statistical attack, will proceed slowly and Dr. Whipple will serve in Dr. Scott's stead as Acting Director of the Bureau of Salesmanship Research.

Directory of American Psychological Periodicals

American Journal of Psychology—Worcester, Mass.: Florence Chandler.
Subscription $5. 600 pages annually. Edited by G. Stanley Hall.
Quarterly. General and experimental psychology. Founded 1887.

Pedagogical Seminary—Worcester, Mass.: Florence Chandler.
Subscription $5. 575 pages annually. Edited by G. Stanley Hall.
Quarterly. Pedagogy and educational psychology. Founded 1891.

Psychological Review—Princeton, N. J.: Psychological Review Company.
Subscription (with Psychological Bulletin) $6. 480 pages annually.
Bi-monthly. General. Founded 1894. Edited by Howard C. Warren.

Psychological Bulletin—Princeton, N. J.: Psychological Review Company.
Subscription $3.25. 480 pages annually. Psychological literature.
Monthly. Founded 1904. Edited by Shepherd I. Franz.

Psychological Monographs—Princeton, N. J.: Psychological Review Company.
Subscription $4 per vol. 500 pages. Founded 1895. Ed. by James R. Angell.
Published without fixed dates, each issue one or more researches.

Psychological Index—Princeton, N. J.: Psychological Review Company.
Subscription $1.25 200 pages. Founded 1895. Edited by Madison Bentley.
An annual bibliography of psychological literature.

Journal of Philosophy, Psychology and Scientific Methods—New York:
Sub-Station 84. Bi-weekly. 728 pages per volume. Founded 1904.
Subscription $3. Edited by F. J. E. Woodbridge and Wendell T. Bush.

Archives of Psychology—Substation 84, New York: Archives of Psychology.
Subscription $5. 600 pp. ann. Founded 1906. Edited by R. S. Woodworth.
Published without fixed dates, each number a single experimental study.

Journal of Abnormal Psychology—Boston: Richard G. Badger.
Subscription $5. 480 pages annually. Edited by Morton Prince.
Bi-monthly. Founded 1906. Entire field of abnormal psychology.

Psychological Clinic—Philadelphia: Psychological Clinic Press.
Subscription $1.50. 280 pages annually. Edited by Lightner Witmer.
Monthly (9 numbers). Orthogenics, psychology, hygiene. Founded 1907.

Training School Bulletin—Vineland, N. J.: The Training School.
Subscription $1. 160 pages annually. Ed. by E. R. Johnstone. Founded 1904.
Monthly (10 numbers). Psychology and training of defectives.

Journal of Race Development—Worcester, Mass.: Louis N. Wilson.
Subscription $3. 460 pages annually. Founded 1910.
Quarterly. Edited by George H. Blakeslee and G. Stanley Hall.

Journal of Educational Psychology—Baltimore: Warwick & York.
Subscription $3. 600 pages annually. Founded 1910.
Monthly (10 numbers). Managing Editor, J. Carleton Bell.
(Educational Psychology Monographs. Edited by Guy M. Whipple.
Published separately at varying prices. Same publishers.)

Journal of Animal Behavior—Cambridge, Mass.: Emerson Hall.
Subscription $5. 450 pages annually. Founded 1911.
Bi-monthly. Robert M. Yerkes, Managing Editor.

The Behavior Monographs—Cambridge, Mass.: Emerson Hall.
Subscription $5. 450 pages per volume. Edited by John B. Watson.
Published without fixed dates; each number a single research.

Psychoanalytic Review—Washington, D. C.: 3617 Tenth St., N. W.
Subscription $5. 500 pages annually. Psychoanalysis.
Quarterly. Founded 1913. Ed. by W. A. White and S. E. Jelliffe.

Journal of Experimental Psychology—Princeton, N. J.: Psychological Review Company. 480 pages annually. Experimental. Founded 1916.
Subscription $3.25 Bi-monthly. Edited by John B. Watson.

Journal of Applied Psychology—Worcester, Mass.: Florence Chandler.
Subscription $4. 400 pages annually. Quarterly. Founded 1917.
Edited by G. Stanley Hall, John Wallace Baird and L. R. Geissler.

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